AGENT FOR EXAM PROCESSING

Submitted by

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WEK 98049

(Session 2000/2001)

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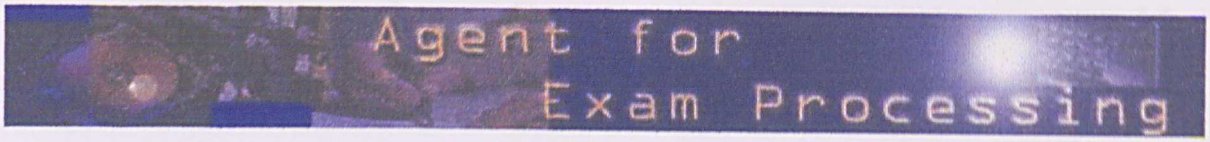

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Under Supervision of
ASSOC. PROF. DR. SAPIYAN BABA

A Graduation Project Submitted to the
Department of Artificial Intelligence
Faculty of Computer Science and
Information Technology,
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in partial fulfillment of the
requirement for the
Degree of Bachelor of Computer Science

ABSTRACT

Exam Processing System is a necessity to every institution of higher learning and universities, due to the amount of students taking exams every year, the blooming of information technology era and achieving the paperless environment goal. It has been implemented to handle student's records or more widely recognized as the Student Information System (SIS). However, based on the current system, it can only keep records and do very little with it, which requires the administrators more time to generate the summary manually. Agent for Exam Processing is proposed to overcome these shortcomings.

The Agent for Exam Processing is an intelligent web application system designed to reduce the time spent on keying in the results, processing it, and come out with a detail summary. The main objective of this agent is to help lecturers, administrators and students to handle the compiled results in a more precise and professionally manner. Most of the required job will be done automatically using computer intelligence, such as recognizing weak students and inform the lecturer, determining the number of credit hours allowed, coming out with result statistics and so on. In this way, students can get their results earlier and register the appropriate number of credit hours for the next semester. It saves the hassle of registering and later dropping some courses after knowing their GPA only allows them to take a certain amount of credit hours. With its user-friendliness, easy maintenance, and intelligence, the agent is able to provide a comprehensive Exam Processing system for the field of education.

The Agent for Exam Processing is divided into three main sections, namely the Access, Administrator, Lecturer and Student. Each of the section has its own modules, which handles different task and operations. Hence, it makes the agent more effective, efficient and

reliable. For instance, lecturers could key in the student's test, quiz, assignment or exam records at any time and view the statistics instantly. All users (administrators, lecturers and students) will be authenticated with their own username and password. Besides that, students will be notified by email when their result is out.

The Agent for Exam Processing is developed with a combination of web programming technologies namely Active Server Pages (ASP), VBScript, HTML. The entire platform of the agent requires Windows NT Server, Microsoft SQL Server, Microsoft Internet Information Server, Windows 95/98/NT/2000 Workstations and Microsoft Internet Explorer 4.0 or above. The Microsoft Visual InterDev and Notepad are selected as the development tools for this project.

ACKNOWLEDGEMENTS

I would like to express my deepest appreciation to the following people, either directly or indirectly, their contributions have helped me a lot in making this project a success.

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I would also like to convey my gratitude to Puan Asiah from Bahagian Perkhidmatan Komputer, in Science Faculty. She has helped me in my research by showing the current system implemented by Universiti Malaya's administrators. The exposure gave me a vast idea of what I am dealing with and ways to improve the current system.

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LIST OF ABBREVIATIONS

ADO	Active Data Object
ARPA	Advanced Research Projects Agency
ASP	Active Server Pages
CGI	Common Gateway Interface
COM	Component Object Model
DBMS	Database Management System
DMO	Distributed Management Objects
FTP	File Transfer Protocol
HTML	Hyper Text Markup Language
HTTP	Hyper Text Transfer Protocol
IIS	Internet Information Server
ISAPI	Internet Server Application Programming Interface
LDAP	Lightweight Directory Access Protocol
NIC	Network Interface Card
ODBC	Open Database Connectivity
OLE	Object Linking and Embedding
RDBMS	Relational Database Management System
RDO	Remote Data Object
SIS	Student Information System
SSL	Secure Socket Layer
TCP/IP	Transmission Control Protocol / Internet Protocol
VBScript	Visual Basic Scripting Edition
W3C	World Wide Web Consortium
WebDAV	Web Distributed Authoring and Versioning
WWW	World Wide Web
XML	Extensible Markup Language

CHAPTER I

INTRODUCTION

CHAPTER I: INTRODUCTION

1.1 PROJECT OVERVIEW

Agent for Exam Processing is a web-based application, which contains a server site (including database system), web server and client server. It uses the Internet/Intranet and browser to present data and receive input. It also enables users to access the application from any location at any time, as long as the users have an access to the Internet/Intranet.

The agent is divided into three main sections and the main users are students and lecturers. The agent will auto-generate a mail to the students automatically and allow them to view their results online. It also enables the lecturers to set the division of marks among the test, quiz, assignments and final exam, and of course keying in the marks. Time and energy will be reduced using the agent's user-friendly environment. The agent will also automatically compile all the result for all the students and come out with a few statistical conclusions. Other than that, any special cases in the result provided by the lecturer will be identified, such as a sudden drop in grades for a particular student, no marks provided for absent students, or weak students which the agent feels that he or she needs more attention in this field. Results analysis is also provided in order to enable the lecturers to evaluate the students' performance.

The Agent for Exam Processing is developed based on a rule-based system implementation. In a way of developing an intelligent system for the exam processing, the whole system will be divided into two major components, which are the Knowledge Base and the rule-based system. The former stores all the constants, information and knowledge provided by the lecturer that the intelligent agent needs to know and the latter sets the rules in running the system. These two major components

communicate among themselves automatically to identify the solutions and make intelligent decisions based on its experience.

In the path of security, the Agent for Exam Processing requires all the users to enter their respective username and password. User friendliness, performance, reliability and manageability have been considered in order to develop an efficient system and fulfill the needs of users.

The agent replaces the current Student Information System (SIS) in a way that it could perform more intelligent tasks and makes simple decision, which could save up a lot of time for the administrators and lecturers. In addition to that, updates and maintenance has become an easy task to the administrators and developer with the separation of knowledge from the rules. Therefore the agent is no doubt better than the current existing systems for exam processing methods.

1.2 PROJECT MOTIVATION

Before and after the examination season in every semester, lecturers, faculties and the administrators in Bahagian Peperiksaan are required to work together in keying in the results, compile, have a meeting on the final grades and come out with the results for every student in the university. Before the exam commence, administrators need to finalize the list of students taking a particular course, the number of papers a student taking, generating student list for invigilators and finally print out examination entry slips to every student. After the exam, the administrators need to identify the absentees, making sure that no papers are misplaced, and generating the result slip after the final grades are confirmed by the board of invigilators. The time frame set for lecturers to mark the exam papers is very limited, and they could not

view the students' performance immediately. Therefore, in order for the students to get their result faster, the Agent for Exam Processing assist the administrators and lecturers in doing all the procedures in a much shorter time in an effortless manner.

The Agent is designed to simplify, help and save the time for all parties concerned in the examination processing procedures. With the web-based concept, the agent is able to reduce the trouble of obtaining students' grades from lecturers to faculty staffs and only finally keyed in by the office staffs in the administration office. The system is designed based on multi-user environment where the lecturers and students are able to access the databank from different places at the same time.

With this intelligent agent, lecturers will be able to determine the percentage of each test, quiz, assignments and exam easily, key in the appropriate grades for their students according subjects, view statistical report and the performance of their students and also be informed about any errors in data entry, weak students or special cases. Besides handling the grades, each lecturer is considered as a student advisor and is assigned with a few students. One of the student advisor's responsibilities is to make sure that the students do well in the semester so that he or she could take the right amount of credit hours in the next semester. In this case, the intelligent agent will automatically list out the names placed under the supervision of the lecturer and also identify students who need more attention and are under probation.

For the students, it will be much help because they could view their final results in much quicker way. To avoid waiting a few weeks for the result slip to be printed out, they could easily obtain the grades through the Internet and serves the purpose of paperless environment. With quick results, students have more time in hand to choose the courses for their next semester, analyze their result and identify their weaknesses,

discuss with their student advisor regarding the grades they are obtaining and have a better view of their performance from the first day they step into the campus.

In general, the Agent for Exam Processing could save cost, energy and most importantly, relieve the lecturers and administrators from the tedious, repetitive and mundane tasks. Thus, it is useful to develop an intelligent web-based Agent for Exam Processing for the administrators, lecturers and students.

1.3 PROJECT OBJECTIVES

The fundamental objectives of the project is to develop a web-based intelligent Agent for Exam Processing that:

- Could handle Student Information System.
- Calculates the marks and grades automatically.
- Keep all the marks and grades from the beginning.
- Provides results analysis for lecturers.
- Alert lecturers when special cases occur.
- Make simple decisions and detect faults.
- Add new rules to the system.

1.4 PROJECT EXPECTATIONS

The project is expected to accomplish and achieve the following results:

- Ensures that the Agent can perform the functions to meet system reliability and user-friendliness.
- Provides the following functions:
  a) Maintain and record all the students' information and grades.
  b) Setting and keying in test, quiz, assignments or exam marks.

c) Results analysis.
d) Viewing and managing the analyzed report.
e) Alert functions.
f) Security.
g) Adding and editing rules that determines the result analysis.

- Provides a comprehensive web-based intelligent agent for the field of education.

1.5 PROJECT SCOPE

The Agent for Exam Processing is an intelligent web application system developed for the Faculty of Computer Science and Information Technology, University of Malaya. Hence, the targeted users for this project are the students and lecturers for this faculty. The whole system is divided into three sections:

1.5.1 Administrator Section

This is the primary section, which has full control over the system managed only by the administrative people. It consists of three major modules and many other sub-modules. The three major modules and its sub-modules are:

i. Change Password Module
   a. Change Administrator's Password
   b. Change Lecturer's Password
   c. Change Student's Password

ii. Student
   a. View Student by Major, Advisor or view all
   b. Sort Student list
   c. Add a Student
   d. Edit Students' Profile
   e. Registering Course for Student

f. Delete a Student

iii. Lecturer

a. Add a Lecturer
b. Edit Lecturers' Profile
c. Assigning Courses to Lecturers
d. Delete a Lecturer

iv. Record Management Module

a. Semester Management
   - Add New Semester

b. Course Management
   - Add New Course
   - Edit Course Information
   - Assigning Course to Semester
   - Changing Marks Allocation
   - Keying in Students' Marks
   - Delete Course

c. Lecturer Management
   - Summary of Courses handled by Lecturers
   - List of Students in Course

d. Student Management
   - Summary of Students' Performance

v. Record Summary Module

a. View Statistics
b. View Lecturers & Students
c. Summary of Courses by Semester

vi. Rule Management Module

a. Add Rule
b. Edit Rule
c. Delete Rule

1.5.2 Lecturer Section

Lecturers would only be given the access to the functions in the Lecturer Section. To keep lecturer's job at a minimum level, the interface of the agent has been made very user-friendly. In addition, help is provided all the time to ease the management. Hence, one does not need to be a computer savvy to use this system.

The main parts in the Lecturer's Section are Course Management Module, Result Analysis Module, Change Password Module and View Student Module.

From Course Management Module, the lecturer could view all the courses conducted by him/her in any semester. In addition to that, lecturers could allocate exam marks for the test and quizzes and keying in students' marks. The marks are automatically computed and results could be seen immediately in the Result Analysis Module. Lecturers can view the summary for the particular course and the list of students and their performance in that course.

Besides that, lecturers could change their password at any time. View Student Module is to keep track of the students under their supervision and view their performance.

1.5.3 Student Section

Users in this section have the least access to the functions and are restricted to only a few modules. The accessible ones are Change Password Module, View Result Module, View Performance Module, View Graduation Path Module and Course Registration Module.

Students could view their latest result and performance according to subjects in the View Result Module and View Performance Module. The

agent will highlight any danger zone where the agent felt that more attention is needed. The View Graduation Path Module enables student to keep track of their completed credit hours till date and the amount left before they graduate. Here, the agent would suggest a combination of courses to be taken by the student for the coming semester according to the GPA of current semester. It could also give reasons to the student for the number of credit hours suggested. The list of courses selected for next semester will be sent automatically to their student advisor for authorization.

1.6 PROJECT DEVELOPMENT LIFE CYCLE

In order to develop an intelligent system that fulfills the needs of end users, a development life cycle as shown in Figure 1.1 is used in the development of the Agent for Exam Processing, which is known as Knowledge Engineering. This development life cycle consists of six phases, which are Assessment, Knowledge Acquisition, Design, Test, Documentation and Maintenance. The difference between this system and other conventional program is that a conventional program focuses on data and it is a sequential process, which only includes design, code and debug. The program is deliverable only after the programmer has completed the final step.

During the *assessment phase*, studies and researches are carried out to determine the problem faced by most universities at the moment. Following this study, the problem is further examined to define the overall goal of this project to specify the importance and the scope of this project.

Knowledge Acquisition phase is where the process of acquiring, organizing and studying knowledge are carried out. Knowledge on the

problem is collected from staffs, lecturers and students to guide the development effort in building a better system for everyone.

Design phase focuses on the best approach to represent the knowledge and problem solving strategies in the intelligent system. During design phase, the overall structure and organization of the system's knowledge are defined. Methods are also defined for processing the knowledge. In this stage, a small system is built, and by reviewing the test result, insight is gained into additional system requirements.

The *testing phase* is a continual process throughout the project. New knowledge are added into the system all the time and followed by additional testing where again the system's knowledge may be modified. The objective of testing is to validate the overall structure of the system and its knowledge.

The *documentation phase*, all of the project's information that can meet the requirements of both the user and developer of the intelligent system are compiled into a document. This document will explain how to operate the system and provide help through the major operational features of the system.

In the final phase, *maintenance phase*, the intelligent agent need to be periodically updated and maintained so the knowledge that it possesses will continually grow, evolves and matures to meet current needs.

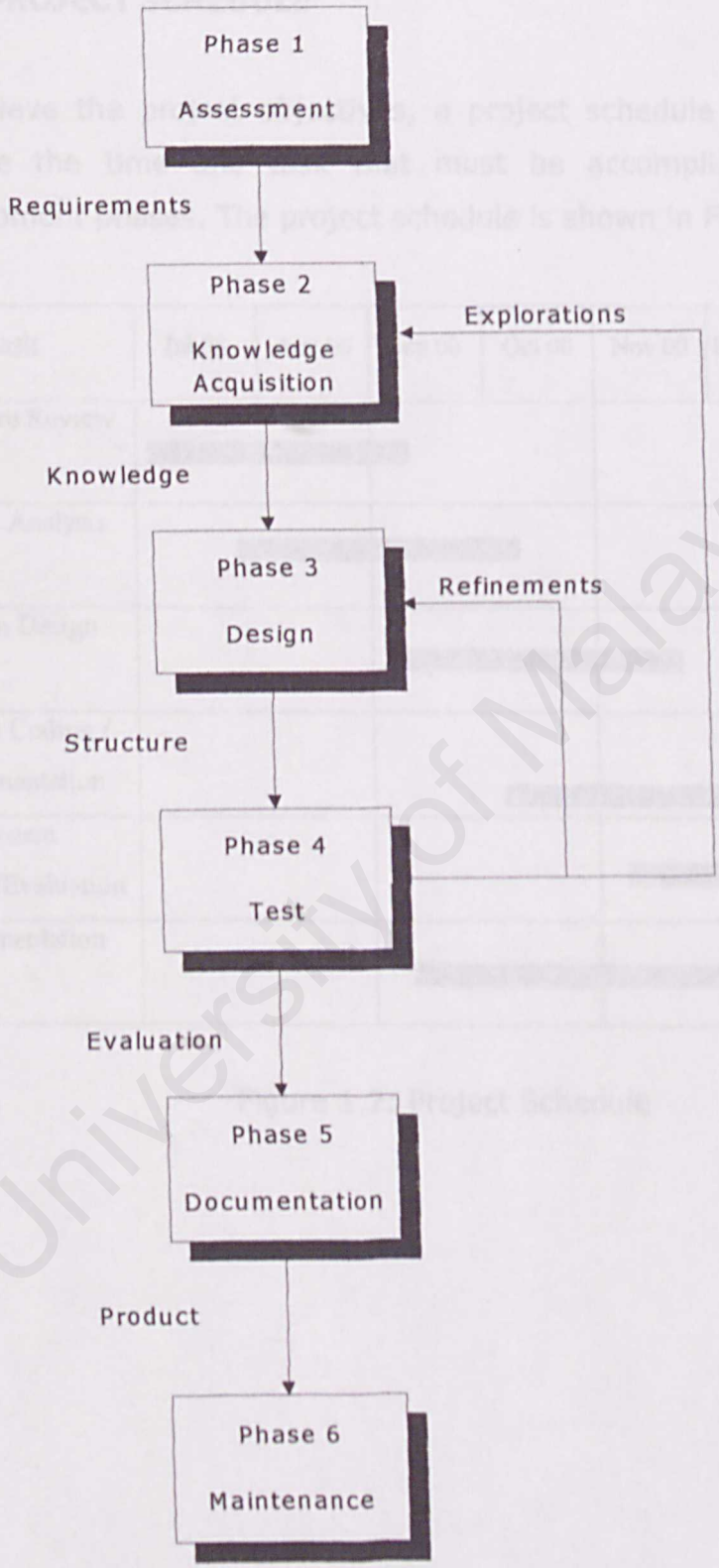

Figure 1.1: Project Development Life Cycle

1.7 PROJECT SCHEDULE

To achieve the project objectives, a project schedule was planned to manage the time and task that must be accomplished within the development phases. The project schedule is shown in Figure 1.2.

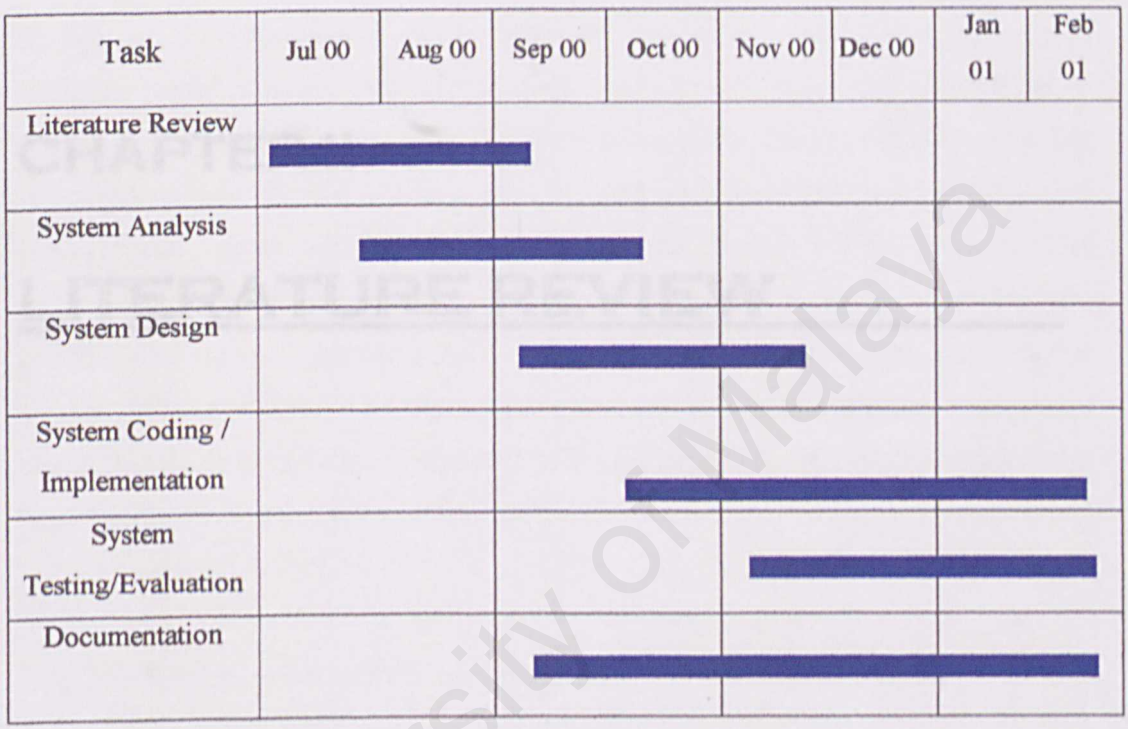

Figure 1.2: Project Schedule

CHAPTER II

LITERATURE REVIEW

CHAPTER 2: LITERATURE REVIEW

2.1 A SURVEY ON EXISTING SYSTEM

2.1.1 Existing System in Bahagian Perkhidmatan Komputer

Bahagian Perkhidmatan Komputer is using a very comprehensive system, which serves many functions dealing with students' information. Some of its modules includes the semester calendar, timetable, the list of subjects for all the majors in UM, pre-examination registration and preparation, post-examination modules and many more. Part of the system is distributed to the office department in every faculty. By connecting online, administrators from each faculty could key in the students' information and their grades accordingly. From there only they will compile the results, come out with analyzed report and approve the final confirmed results.

2.1.2 Existing System on the Web

There are not much agents for processing exam results published in the Internet. One of the examples that I have found is listed below.

PowerSchool is the leading provider of web-based student information systems to K-12 schools. Their objective is to partner with schools to improve the quality and effectiveness of education by empowering students, parents, and educators with real-time information, relevant assessment tools and access to educational resources online.[1]

It has divided the system to four main parts, namely Students, Parents/Guardians, Teachers and Administrators.

Students can get real-time access to academic progress so they know exactly where they stand. PowerSchool offers a doorway to the best educational resources online helping students improve their performance by giving them the information they need to succeed.

Parents/Guardian can access their child's performance in real time. They can review grades, check attendance and correspond through email with teachers, allowing them to take an informed and proactive role in their child's education. PowerSchool provides a doorway to online resources specifically designed to help them help their children.

Teachers can electronically record grades and attendance so they can focus on what they do best, teaching. This information is immediately available online to parents through a confidential login and to administrators, minimizing the paperwork teachers need to generate.

Administrators can generate reports without manually transferring data or creating additional paperwork. The system's web-based architecture significantly reduces the costs associated with installations and software upgrades. PowerSchool is scalable so only one server is needed for an entire district.

2.2 INTERNET

2.2.1 About the World Wide Web

The Internet, sometimes called simply "the Net," is a worldwide system of computer networks - a network of networks in which users at any one computer can, if they have permission, get information from any other computer. It was conceived by the Advanced Research Projects Agency (ARPA) of the U.S. government in 1969 and was first known as the ARPANet. The original aim was to create a network that would allow users of a research computer at one university to be able to "talk to" research computers at other universities. A side benefit of ARPANet's design was that, because messages could be routed or rerouted in more than one direction, the network could continue to function even if parts of it were destroyed.

From there, in 1980, at a place called CERN (European Laboratory for Particle Physics), a man named Tim Berners-Lee envisioned the development of a worldwide computer interconnection that would provide access to all sorts of information and files for the physics community. In 1989, after years of toying around with his vision of a more interactive world, he submitted a proposal that was to be the beginning of the World Wide Web (WWW).[2]

The Web has been the most common way for businesses to establish their presence in the Internet. The Web has two major components, a Web Browser and a Web Server. The browser is a software for accessing the Web Server that stores files using HTML.

A Web Server stores information in a series of text files called pages. These text files or pages use a structured language called HTML (HyperText Markup Language) to store their information. HTML enables the author of a page to define different type styles and sizes for the text, titles, and headings. HTML also allows the author to define links to other

pages that may be stored on the same Web Server, or on any Web Server anywhere in the Internet.[3]

2.3 CLIENT / SERVER ARCHITECTURE

Client / Server computing is currently attracting the most interest among management information systems professionals. The popularity of this approach is due to its ability to allow companies to selectively centralize and decentralize certain key operations. Thus, users can view client/server computing as a cross between the timesharing method (which emphasizes centralized computing) and distributed processing (which emphasizes decentralized computing). In client/server computing, the various applications available in the network are shared by several clients and one or more host computers (or servers). Clients obtain access to the network by means of desktop computers. The server, which can be a microcomputer, minicomputer, or mainframe, provides control for the entire network.

Many definitions of this architecture exist, ranging from an Access application with a share database to an all-encompassing transaction processing system across multiple platforms and databases. Throughout all the permutations and combinations, some major themes remain consistent:

- Requestor / Provider Relationship

  The client and the server have well-defined roles, the client requesting a service and the server fulfilling the service requested.

- Message-Based

  The communication between the client and server (or the client middleware server) is a well-defined set of rules that govern all

communication – a set of transactions that the client sends to be processed.

- Platform Independence

  Due to the clearly defined roles and message-based communication, the server or service provider is responsible for fulfilling the request and returning the requested information (or completion code) to the client. The incoming transaction can be from a Window client, an OS/2 machine, or a Web browser.

- Dynamic Routing

  The client can send a transaction to a service provider and have the request fulfilled without having to be aware of the server that ultimately fulfill the request. A database server, a mid-range data update, or a mainframe transaction might satisfy the data or transaction.[4]

2.3.1 Two-tier Client / Server

In the traditional two-tier client/server environment much of the processing is performed on the client workstation, using the memory space and processing power of the client to provide much of the functionality of the system. Field edits, local lookups, and access to peripheral devices (scanner, printer, and so on) are provided and managed by the client system.

In this two-tier architecture, the client has to be aware of the data resides and what the physical data looks like. The data may reside on one or more database servers, on amid-range machine, or on a mainframe. The formatting and displaying of the information is provided by the client application as well. The server(s) would routinely provide access to the data. The ease and flexibility of these two-tier products to

create new applications continue to be driving many smaller scale business applications.[5]

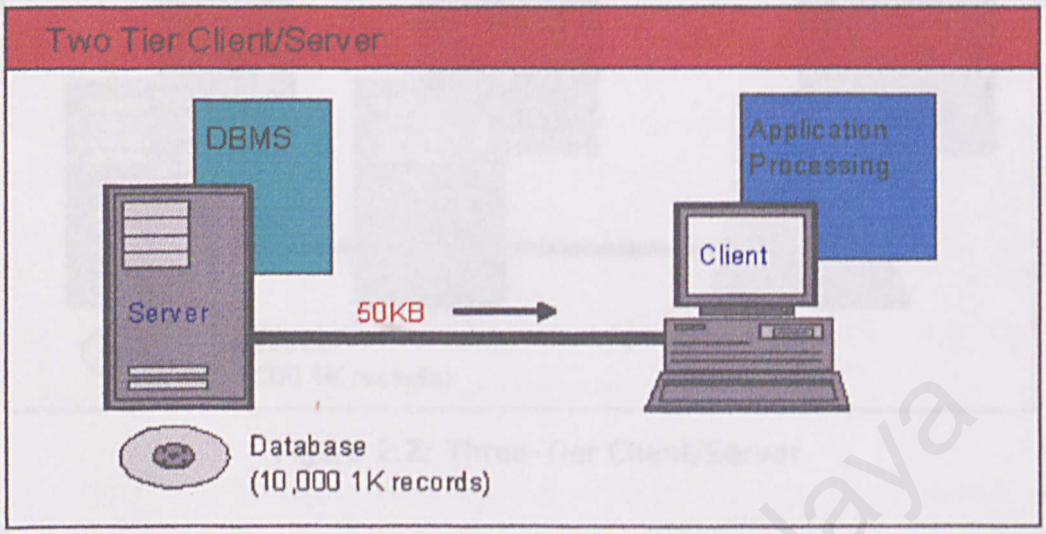

Figure 2.1: Two-tier Client/Server

2.3.2 Three-tier (Multi-tier) Client / Server

The three-tier, later to be called multi-tier architecture grew out of this early experience with "distributed" applications. As the two-tier applications percolated from individual and departmental units to the enterprise, it was found that they do not scale very easily. And in our ever-changing business environment, scalability and maintainability of a system are the primary concerns. Another factor that contributes to the more from two-tier to multi-tier systems is the wide variety of clients within a larger organization.

In multi-tier architecture, as shown in Figure 2.2, each of the major pieces of functionality is isolated. The presentation layer is independent of the business logic, which in turn, is separated form the data access layer. This model requires much more analysis and design on the front-end, but the dividends in reduced maintenance and greater flexibility pays off time.[6]

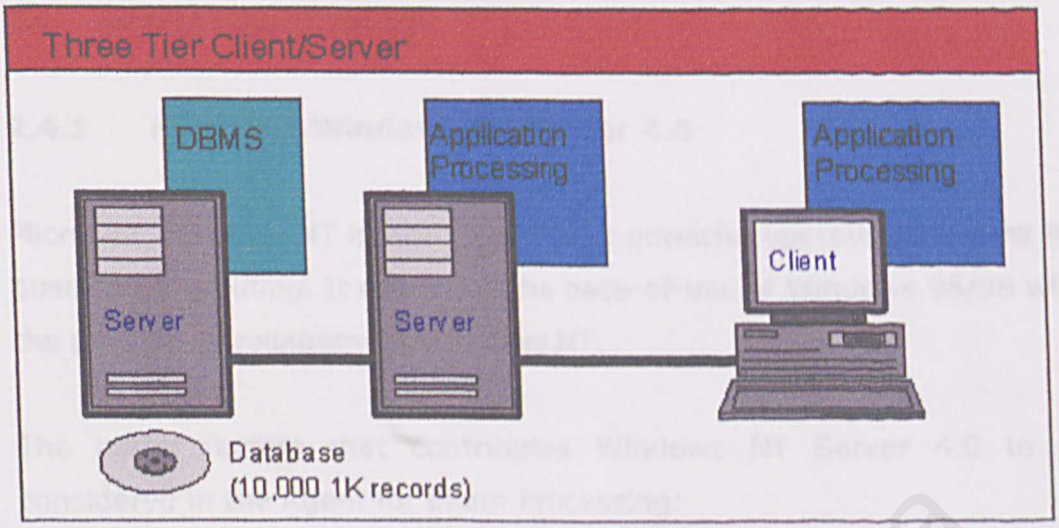

Figure 2.2: Three-Tier Client/Server

2.3.3 Advantages of using three-tier Client / Server's Architecture

Three-tier client/server's architecture advantage in addressing scalability lies in its middle tier. The middle tier insulates the application from heterogeneous environment issues and provides for economies of scale – developer productivity, application consistency – across the enterprise by enabling key services to be shared by multiple applications. [7]

2.4 OPERATING SYSTEM

2.4.1 Microsoft Windows NT Server 4.0

Microsoft Windows NT is one of the most powerful operating systems for business computing. It combines the ease-of-use of Windows 95/98 with the power and reliability of Windows NT.

The major factors that contributes Windows NT Server 4.0 to be considered in the Agent for Exam Processing:

- It's ease-of-use interface, which helps user to work easier and faster.
- It is easy to manage and control as it includes remote management and troubleshooting tools and allows administrators to implement policies and standards for system-wide desktop configurations.
- It's productivity and compatibility as Windows NT ensures high performance for 32-bit programs. All Win16 Windows-based programs have the preemptive multitasking capabilities of Windows NT and can be run in a separate address space for better responsiveness and reliability.
- It meets the reliability standards to run critical line-of-business programs. It allocates separate memory space for 16-bits applications, so if one 16-bit application fails, it won't bring down other application. It also protects critical operating system code, device drivers, and data from applications.
- It supports workgroup and networking. Windows has the built-in file sharing and print-sharing capabilities for workgroup computing. It also has open network system interface that is compatible with Banyan Vines, NetWare, Novell, UNIX, Macintosh, and LAN manager, as well as Microsoft Windows for Workgroup,

Windows 95/98, and standard x86 environment. Up to 10 simultaneous connections can be made to a Windows NT computer for sharing files and printers.

- It allows Object Linking and Embedding (OLE). In other words, it can combine information from several applications into one compound document using the special object linking and embedded capabilities of Windows-based application.
- It has built-in tools for internetworking and intranetworking like TCP/IP, Microsoft Internet Explorer, and Microsoft Peer Web Services.
- It enables the capabilities of integrating application on a single computer or even across multiple computers by using COM and DCOM.[8]

2.4.2 Microsoft Windows 2000

The Windows 2000 Server operating system integrates Internet technologies across all services, from File and Print to advanced line-of-business application services. This helps ensure organizations can more effectively exchange information with customers, partners, and employees worldwide.

Windows 2000 Server meets the needs of a broad spectrum of users, from corporate intranets to Internet Service Providers hosting Web sites receiving millions of hits per day. Because Internet Information Server 5.0 (IIS) is fully integrated at the operating system level, Windows 2000 Server lets organizations add Internet capabilities that weave directly into the rest of their computing infrastructure.

Specifically, Windows 2000 Server lets organizations:

- Share information more efficiently using the Web.

In the past, performing standard file operations on a network file share was much easier than performing similar operations on a remote Web site. Now, Windows 2000 Server technologies such as Web Distributed Authoring and Versioning (WebDAV) make it as easy to carry out standard file operations on a Web share.

- Create Web-based business applications.

  Creating Web-based applications that integrate well into traditional business applications can be difficult. Windows 2000 Server overcomes this burden by sharing internet-aware application development tools with IIS, an efficiency that extends applications to the Web and eliminates awkward bridges between internal and external processes.

- Bring server operating system functionality to the Web.

  In addition to allowing organizations to extend basic file and print services to the Web, Windows 2000 Server supports applications, media, and communications and networking services from a common server platform. This convergence means that everything a company can do with Windows 2000 Server is automatically supported in a fully integrated Web environment.

2.5 WEB SERVER

2.5.1 Microsoft Internet Information System (IIS)

Microsoft Windows NT Server 4.0, with its built-in Web server Internet Information Server (IIS) 4.0, is the easiest way to publish information and bring business applications to the Web. IIS is designed to meet these needs for a wide range of users, from workgroups and departments on a corporate intranet to Internet Service Providers

hosting Web sites that receive millions of hits per day. IIS 4.0 revolutionizes the Web capabilities of the Microsoft Windows NT Server version 4.0 operating system by providing the easiest way to share information, build and deploy business applications, and host and manage sites.

IIS incorporates World Wide Web (WWW), File Transfer Protocol (FTP), Index Server, and Secure Socket Layer (SSL) services. IIS provides a comprehensive set of tools for managing the Web Server and its components.

- IIS provides the highest performance of any Web server on Windows NT Server and delivers superior price performance to comparable UNIX-based systems. In addition, the application services of Windows NT Server provide a reliable and scalable platform for building and deploying Web-based applications.
- Only IIS brings the security of Windows NT Server, without additional configuration, to protect information with the ease of a single user directory and the ability to log on to a network.
- Windows NT Server with IIS is the only solution that provides an integrated set of tools for running and managing all of the network, Web, and application services reducing training time for administrators.

2.5.2 Microsoft Exchange Server

Microsoft Exchange Server integrates e-mail, group scheduling, electronic forms, and groupware applications on a single platform that can be managed with a centralized, easy-to-use administration program. It is designed to make messaging easier, more reliable, and more scalable for business of all sizes.

Microsoft Exchange Server provides the following features:

- Industry-leading scalability

  Unlimited storage capacity in Exchange Enterprise and support of SMP enable hosting thousands of users per server on Microsoft Windows NT-class hardware. Single-instance message store maximizes disk usage.

- Highest performance

  Native implementation of Internet standards provides the fastest MAPI, POP3, IMAP4, and NNTP server so that users can be working and not waiting for their server to respond.

- Security

  The communication is secure whether internal to the organization or across the Internet through unified Exchange and Windows NT logon, password expiration, and support for the latest encryption standards including SSL, E/SMTP, SASL, and digital signatures.

- Superior integration with Windows NT

  Tight integration with the Windows NT directory and common performance monitoring and administration tools simplifies Exchange management and reduces total cost of ownership. Exchange delivers advance support of the Active Directory Service Interface to be delivered in Windows NT 5.0.

- Active Server Pages

  Exchange provides this Web-based approach to building collaboration solutions running on Microsoft Internet Information Server (IIS) and accessing services of BackOffice.[9]

2.6 WEB DATABASE

2.6.1 Overview of Database

A database is a collection of data, interrelated tables and other related objects, such as views, defaults, rules, stored procedures and triggers that are organized to serve a specific purpose. From a logical perspective, the related entities with their actions and event-handling methods are collectively considered as a database. The concept of database is important because it determines how data is stored physically and how data is mapped to a physical device.

The physical space that is assigned to a database during its creation is called a *device*. In other words, a device is a physical storage media that stores the database.

2.6.2 Microsoft SQL Server 6.5

SQL Server is a high-performance scaleable Relational Database Management System (RDBMS), which meets the requirements of client/server computing. In addition to the usual features of an RDBMS, SQL Server has features that are unique to it. It uses the features of other Database Management Systems (DBMS) and some features that are unique to this RDBMS. SQL Server is strongly integrated with Windows NT operating system. NT provides unique and useful features to implement database design and database administration together with high reliability.

SQL Server permits client applications to access and manipulate the information retrieved from the server by using several specialized tools and techniques. SQL Server includes the following features:

- Integration with Windows NT: This helps in threading, and scheduling of services. Monitoring performance by using Performance Monitor and handling events by using the Event Viewer increase the flexibility in database manipulation across a geographically wide network in client/server architecture. Integration with Windows NT provides simplification in user account management with a single Windows NT logon, which is also valid for SQL Server logon.
- Built-In Replication: This is a functionality to replicate data for reliable publication of information throughout a network. Built-in replication is extended to support publication to heterogeneous databases that are using Open Database Connectivity (ODBC).
- Parallel Architecture: SQL Serer executes database functions in parallel to improve the performance and scalability of the system.
- Centralized Management of Servers: The servers are Windows-based management interfaces, which provide visual drag-and-drop control over multiple servers for remote management of data publication, server administration, diagnostics and performance tuning.
- Support for Large Database: Using parallel architecture reduces input/output (I/O) for many development and maintenance tasks.
- A library of 32-bit OLE Distributed Management Objects (DMOs): The DMOs are available in the Distributed Management Framework.

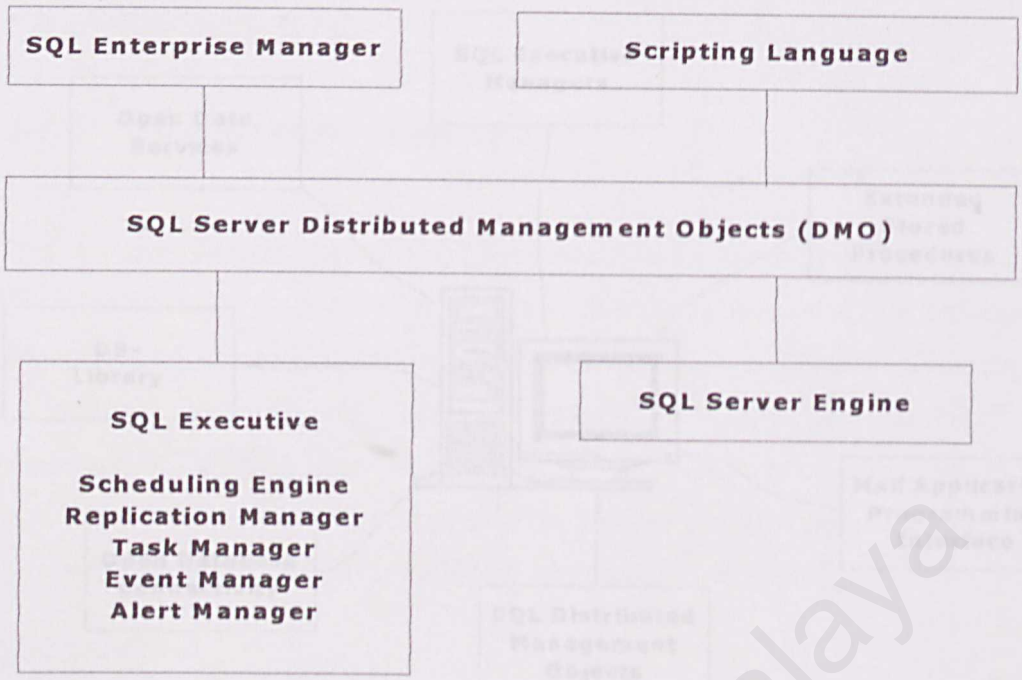

Figure 2.3: Distributed Management Framework

2.6.3 SQL Server Extensions

SQL Server is capable of extending itself beyond its environment to the client side or the server side. The following are some of components that make this possible:

- SQL Executive Manager
- Extended Stored Procedures
- Mail Application Programming Interface (MAPI)
- SQL Distributed Management Objects (SQL-DMO)
- Open Database Connectivity (ODBC)
- DB-Library
- Open Data Services (ODS)

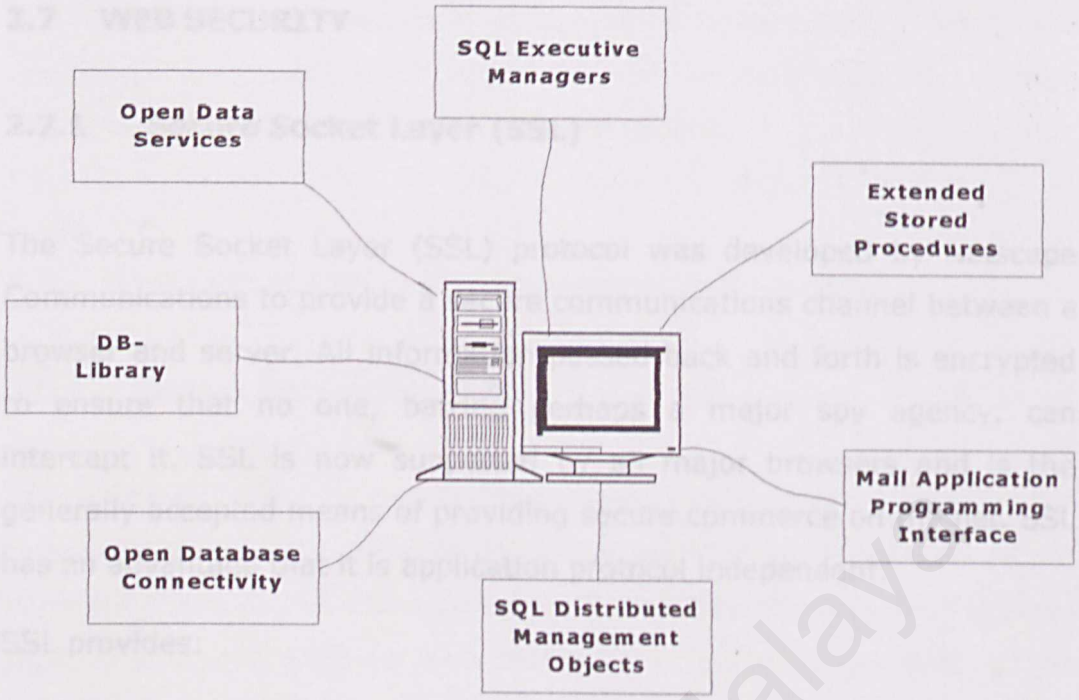

Figure 2.4: SQL Server Extensions

2.6.4 SQL Server 2000

SQL Server 2000 includes many new features that extend its capabilities as a high performance relational database system with a rich development environment. It supports new product features including AWE support, new data types, new user-defined and built-in functions as well as enhancements in trigger functionality, indexing, collation, and property definition. Besides that it also covers on XML support, covering XML data retrieval and manipulation, queries, and HTTP access.

2.7 WEB SECURITY

2.7.1 Secure Socket Layer (SSL)

The Secure Socket Layer (SSL) protocol was developed by Netscape Communications to provide a secure communications channel between a browser and server. All information passed back and forth is encrypted to ensure that no one, barring perhaps a major spy agency, can intercept it. SSL is now supported by all major browsers and is the generally accepted means of providing secure commerce on the net. SSL has an advantage that it is application protocol independent.

SSL provides:

- Server authentication, which allows any SSL-compatible client to verify the identity of the server using a certificate and a digital signature.
- Data encryption, which ensures the privacy of client-server communications by encrypting the data stream between the two entities.
- Data integrity, which verifies that the contents of a message arrive at their destination in the same form as they were sent. [10]

SSL integrates security beneath application protocols such as HTTP, NNTP, and Telnet. SSL provides a security "handshake" to initiate a TCP/IP connection, resulting in the client and server agreeing to the security level used, and fulfilling any Digital ID authentication requirements for the connection.

HTTP + SSL (or "https") and HTTP are different protocols and typically reside on different ports (443 and 80, respectively). The same system

can run secure and insecure HTTP servers simultaneously. This means developer can provide some information to all users using no security, and other information to some users with security.[11]

2.8 WEB APPLICATION PROGRAMMING TECHNOLOGY

2.8.1 Active Server Pages (ASP)

Active Server Pages is a new technology from Microsoft that provides the capability for the Web server to process application logic and then deliver standard HTML to the client browser. The results can then be delivered to a variety of client-side Web technologies, such as standard HTML, ActiveX, Java, browser plug-ins, and DHTML.

Although fairly straightforward, this simple concept has great ramifications in shifting traditional applications to the Web. The first direct result of using Active Server Pages is that only HTML is sent to the client's browser. ASPs do not automatically send ActiveX controls to the browser. By default, ASPs send only ASCII text to the browser. This lets any browser types running on any operating systems to access the applications and workflow logic embedded in the ASP scripts.[12]

Active Server Pages is being considered for the Agent for Exam Processing project because of its main features especially in the web server technology. Some of the main features are:

- It is suitable for publishing and collecting data on the web.
- It provides a way for building secure transactions, server-based applications and web sites.
- It works together with Windows NT and IIS to provide a comprehensive set of key software technologies which enable

secure exchange of information over public networks, access to control to server resources and confident identification of server and client.

- It provides Active Database Object, one of the Active Server Components allows easy but powerful connections to be made to almost any database system for which an Open Database Connectivity (ODBC) driver is available.
- It has pre-build Active Server Components, which provide plug-in objects that will perform specific tasks.
- It can interact with almost any existing dynamic web page technology such as CGI (Common Gateway Interface), ISAPI (Internet Server Application Programming Interface) and scripts written in PERL, Python and AWK.
- It is suitable for building multi-tier Internet and Intranet applications.
- It supports clients-server programming. Furthermore, the combination of ASP, client-side scripting and objects can be used to create client/server applications.
- It is able to create clients side code dynamically on the server.[13]

2.8.2 ASP compared to CGI application

ASP provides all of the functionality of CGI applications in an easier to use and more robust environment.

ASP is an easier way for server to access information in a form not readable by the client (such as an SQL database) and then act as a gateway between the two to produce information that the client can view and use.

With CGI, the server creates as many processes as the number of client requests received. The more concurrent requests there are, the more concurrent processes created by the server. However, creating a process for every request is time consuming and requires large amount of server RAM. In addition, this can restrict the resources available for sharing from the server application itself; slowing down performance, and increasing wait times on the Web.

ASP instead runs in the same process as the Web server, handling client requests faster and more efficiently. It is much easier to develop dynamic content and Web application with ASP.

2.8.3 ASP compared to PERL

PERL and other scripting languages are not robust development tools by themselves. ASP provides a familiar framework and objects for building complex applications that require data from relational databases and legacy sources. ASP supports virtually any scripting language to build these applications. Third parties are currently developing additional scripting engines, such as PERL, which will be announced when they are ready.

2.8.4 Extensible Markup Language (XML)

XML is a meta-markup language that provides a format for describing structured data. This facilitates more precise declarations of content and more meaningful search results across multiple platforms. In addition, XML will enable a new generation of Web-based data viewing and manipulation applications.

XML provides a structural representation of data that can be implemented broadly and is easy to deploy. XML is a subset of SGML optimized for delivery over the Web; defined by the World Wide Web Consortium (W3C), XML ensures that structured data will be uniform and independent of applications or vendors. This resulting interoperability is kick-starting a new generation of business and electronic-commerce Web applications.

Once the data is on the client desktop, it can be manipulated, edited, and presented in multiple views, without return trips to the server. Servers can now become more scalable, due to lower computational and bandwidth loads. Also, since data is exchanged in the XML format, it can be easily merged from different sources.

XML is valuable to the Internet, as well as to large corporate intranet environments, because it provides interoperability using a flexible, open, standards-based format, with new ways of accessing legacy databases and delivering data to Web clients. Applications can be built more quickly, are easier to maintain, and can easily provide multiple views on the structured data.

Here are a few examples of how XML will make the Internet a lot more useful:

- Internet searches: XML lets Web authors add tags to the browser -- like "food" and "electronics" -- to signal meaning so the searches can become much more precise.
- Customized views of information: In combination with Dynamic HTML's data binding feature, XML lets Web developers present information as many different ways as people want it. Users can

then manipulate the data and view it in other ways without having to call the server. XML gives the information users need, presented the way *users* want to see it.

- Bringing information together from different sources: Because XML recognizes information independent of where it came from, companies can package data from many different sources and make it available on a single Web page over an intranet. XML's easy customization described above then lets companies deliver the information exactly the way their different users need it.
- Exchanges between specialty groups: XML lets communities of users come up with their own vocabularies to make communication flow quickly and easily.
- Instant updates: XML is nimble enough with numbers that it can send updates to individual cells in a table, for instance, without updating the whole table and making users sit around and wait.
- Electronic commerce: XML assigns separate tags to each kind of number so your browser can send and receive only the information needed.

2.8.5 Dynamic HTML

Dynamic HTML, the application program interface (API) for HTML, allows an author to take advantage of the processing power of the client to create pages that can be modified on the client, without having to access the server for each change. This freed Web pages from having to be static, and extra trips to the server were no longer required. If the author wanted a word to be blue, one line of script could be added. With Dynamic HTML, a new level of interactivity could be achieved quickly and easily on the client side without going back to the server for a brand new page.

Dynamic HTML has facilitated the development of "real" applications using HTML and other Web technologies. Developers can use simple and straightforward HTML to quickly create applications that previously took much longer to develop using traditional tools. The ease with which these Web based applications could be created and updated has provided corporations with an improved solution to the difficult update and deployment issues they have had with many internally developed applications.

2.8.6 ColdFusion

ColdFusion is a software tool emerged to assist Web developers with the programming required to produce dynamic pages for server-side databases. Software of this kind is called *middleware* because it acts as an intermediary between the Web server software and the target database.

Allaire's ColdFusion is one middleware product that has proved to be immensely popular, which runs on the same machine as the Web server. The major steps in the delivery of a ColdFusion based page are:

- The user request a file containing ColdFusion code (called ColdFusion *template*) or submits a form that has a ColdFusion template as its ACTION attribute.
- The Web server hands the template over to the ColdFusion Application Server for processing.
- The ColdFusion Application Server parses out the programmatic instructions, makes all necessary calls to server-side databases via Open Database Connectivity (ODBC) drivers, performs any required data manipulation, and then prepares an HTML document as its response to the server.

- The HTML document is returned to the Web server, which in turn, sends it to the user's browser.

In addition to its capability to interact with ODBC-compliant databases, ColdFusion extends its usefulness with the capability to interact with other services running on the server. These include:

- Mail servers
- Lightweight Directory Access Protocol (LDAP) directory servers
- Verity search engine collections
- Java applets
- COM/DCOM objects

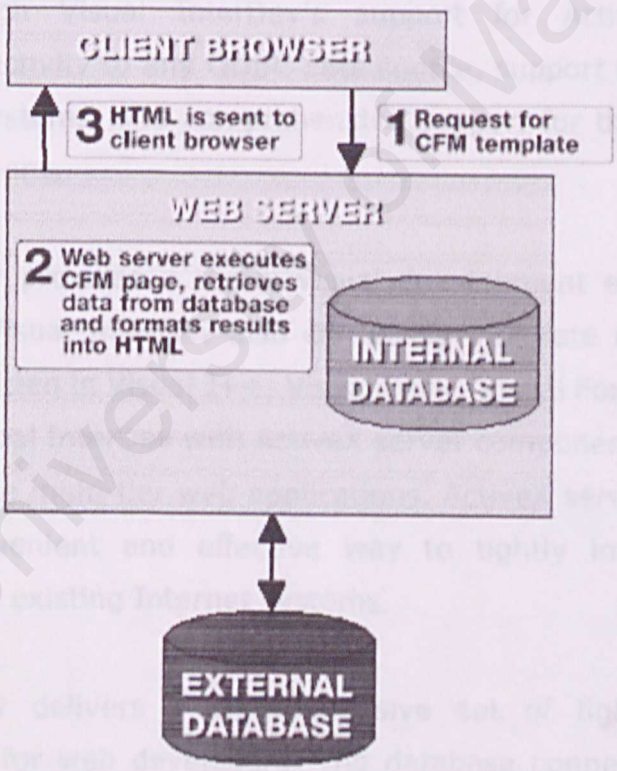

Figure 2.5: Cold Fusion Process

2.9 WEB APPLICATION DEVELOPMENT TOOLS

2.9.1 Microsoft Visual InterDev 6.0

Microsoft Visual InterDev, a member of the visual tool family, is an integrated development tool for building dynamic web applications accessible to any web browser on any platform. It includes an integrated development environment, database connectivity tools, programmable components, site management and publishing capabilities, a personal Web Server, content creation tools and more.

Visual InterDev also includes a variety of development features for integrating client/server and Web technologies. These features are enabled through Visual InterDev's support for ActiveX, seamless database connectivity to any ODBC data source, support for building and testing large systems, and comprehensive support for the development of web applications.

Visual InterDev provides a rapid, visual development environment for building ASP. Visual InterDev also can easily integrate Active X server components written in Visual J++, Visual Basic, Visual FoxPro, and Visual C++. Using Visual InterDev with ActiveX server components, a developer can easily create multi-tier web applications. ActiveX server components provide a convenient and effective way to tightly integrate a web application with existing Internet systems.

Visual InterDev delivers a comprehensive set of tightly integrated database tools for web developers. The database connectivity features are based on the industry Standard ODBC, including Oracle, Microsoft SQL server, Microsoft Access, Microsoft Visual FoxPro, Informix, Sybase, IBM DB/2 and way other. In addition, using Visual InterDev, a developer can create scalable database solutions because it leverages ASP. The

core database components of Visual InterDev include Active Data Object (ADO), Integrated Data view, design-time ActiveX Controls, Database Wizards, Query Designer, Database Design.

A Visual InterDev project consists of a live web site when developers open a "project" they are actually opening a live view of a site as it exists on the web server. The IDE is thus a complete web site management tool that allows the developer to easily modify the structure of a web site and to edit, add, move, rename and delete files and folders on the web site. Multiple web sites (projects) can be opened at the same time.[14]

2.9.2 Matlab

MATLAB is an integrated technical computing environment that combines numeric computation, advanced graphics and visualization, and a high-level programming language. MATLAB includes hundreds of functions for:

- Data analysis and visualization
- Numeric and symbolic computation
- Engineering and scientific graphics
- Modeling, simulation, and prototyping
- Programming, application development, and GUI design

MATLAB is used in a variety of application areas including signal and image processing, control system design, financial engineering, and medical research. The open architecture makes it easy to use MATLAB and companion products to explore data and create custom tools that provide early insights and competitive advantages.[15]

MATLAB supports the entire analysis process, from data acquisition to presentation-quality output. MATLAB provides a range of functions for data analysis and incorporates:

- Data access tools, including data acquisition and database connectivity
- Optimized numeric computing
- Functions for data manipulation and reduction, such as interpolating, scaling, extracting sections of data, and smoothing and filtering
- A comprehensive collection of signal processing tools for developing algorithms, analyzing signals and linear systems, and time-series data modeling
- Hundreds of advanced toolbox functions for applications such as optimization, neural networks, statistics, and control system design
- Practical, engineering and scientific graphics

With MATLAB, users can analyze all kinds of data including signals, images, polynomials, time histories, multivariate data, and linear systems. The insights users gain from the analyses become the building blocks for future mathematical algorithms and predictive models.[16]

2.9.3 Visual Prolog

Visual Prolog is a complete programming environment based on the Prolog programming language. It contains everything needed for building large-scale commercial applications: graphical development

environment, compiler, linker and debugger. Visual Prolog is the successor of Turbo Prolog and PDC Prolog.

Visual Prolog includes a large library with bindings to a range of APIs: Including Windows GUI, ODBC/OCI databases and Internet (sockets, ftp, http, cgi, etc). The development environment is written entirely in Visual Prolog, and contains a number of Code Experts and graphical editors for dialogs, menus, toolbars etc.

Visual Prolog supports: Windows 3.x/95/98/NT/2000, OS/2 and text-mode support for DOS, Linux and SCO UNIX

Visual Prolog is very well suited for expert systems, planning and other AI related problems.[17]

Advantages of Prolog

Short Development Time

In Prolog the number of program lines required to solve a given problem is typically only a fraction of that required by a procedural programming language like C or Pascal. Clearly this can reduce development costs considerably, and since the code is easier to modify, ongoing maintenance costs are often lower as well.

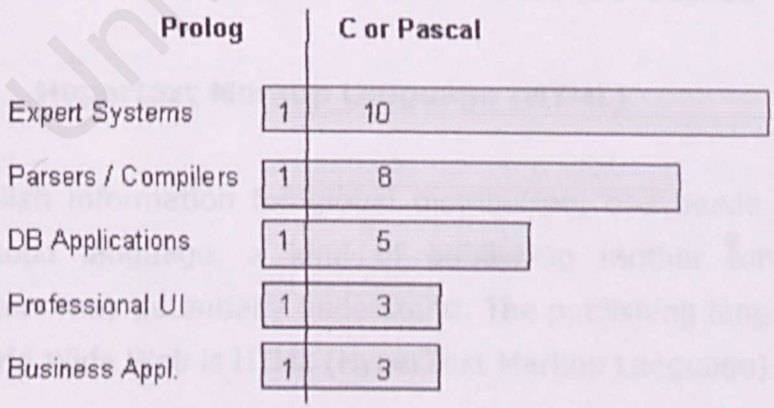

Figure 2.6: Comparison between Prolog and C or Pascal

Easy to Read - Easy to Modify - Easy to learn

Many of the common programming errors in languages like C or Pascal - for example a loop that iterates one too many times or an un-initialized variable - are eliminated in Prolog. Prolog code can be thought of as a well-structured problem specification, in addition to being executable. Such code is easily read and easily modified when aspects of the domain in question change.

Easy Manipulation of Complex Data Structures

Working with complex data structures like trees, lists or graphs often mean big and complex programs managing allocation and de-allocation of memory. Procedures operating on such data structures are almost impossible to keep up to date when the design of the data structure is changed. By contrast, Prolog has a simple and elegant notation for recursively defining and accessing such data structures, shielding the programmer from all details of pointers and explicit storage management.

2.10 WEB APPLICATION PROGRAMMING LANGUAGE

2.10.1 Hypertext Markup Language (HTML)

To publish information for global distribution, one needs a universally understood language, a kind of publishing mother tongue that all computers may potentially understand. The publishing language used by the World Wide Web is HTML (HyperText Markup Language).

HTML gives author the means to:

- Publish online documents with heading, text, tables, lists, photo, etc.
- Retrieve online information via hypertext inks, at a click of a button.
- Design form for conducting transactions with remote services, for use in searching for information, making reservations, ordering products, etc.
- Include spreadsheets, video clips, sound clips, and other application directly in their document.

Most people agree that HTML documents should work well across different browsers and platforms. Achieving interoperability lowers costs to content providers since they must develop only one version of a document. If the effort is not made, there is much greater risk that the Web will devolve into a proprietary world of incompatible formats, ultimately reducing the Web's commercial potential for all participants.

Each version of HTML has attempted to reflect greater consensus among industry players so that the investment made by content providers will not be wasted and that their document will not become unreadable in a short period of time.

HTML has been developed with the vision that all manner devices should be able to use information on the Web. PCs with graphic displays of varying resolution and color depths, cellular telephones, hand held devices, devices for speech for output and input, computers with high or low bandwidth and so on.

2.10.2 Visual Basic Scripting

Microsoft Visual Basic Scripting Edition (VBScript) is a subset of the Microsoft Visual Basic language. It is implemented as a fast, portable, lightweight interpreter for use in WWW browsers and other applications that use Microsoft ActiveX controls, Automation servers, and Java applets. VBScript is currently available as a part of Microsoft Internet Explorer and Microsoft Internet Information Server.

When used in Microsoft Internet Explorer, VBScript is directly comparable to Microsoft JavaScript (not Java). Like JavaScript, VBScript is a pure interpreter that processes source code embedded directly in the HTML. VBScript code, like JavaScript, does not produce standalone applets but is used to add intelligence and interactivity to HTML documents. For programmers who already know Microsoft Visual Basic, VBScript is a valuable alternative to JavaScript in activating web pages.

There are three separate classes of objects available within VBScript:

- Objects provided by the VBScript engine
- Objects provided by Internet Explorer
- Objects provided by the Web page author

The VBScript engine provides the code run-time functionality – a subset of the full Microsoft Visual Basic language – including a minimal set of basic objects. Microsoft Internet Explorer provides the vast majority of objects used in scripting. In general, Internet Explorer provides anything that is specific to the Internet, and anything that is generally useful is provided directly in VBScript. The web author can insert additional objects through the <OBJECT> HTML tag.

The primary motivation for using VBScript in the Agent for Exam Processing is as an alternative to JavaScript and Java. If, for instance, an

application for the Agent for Exam Processing requires the use of a scripting language, VBScript can be used if the application is written to support Microsoft ActiveX Scripting, since doing to will allow it to host VBScript. An important bonus to this is because ActiveX Scripting is an open standard, the application can also host any other language that is written to that standard.

2.11 DATABASE CONNECTIVITY

2.11.1 Remote Data Object (RDO)

RDO is specifically designed to deal with remote intelligent data sources. It provides a high granularity of control over remote data sources so that the need to resort to the exposed Open Database connectivity (ODBC) interface handle is not required. RDO also include the ability to create local cursors as well as dissociate result sets and connections.

RDO is also fully asynchronous and event-driven. With RDO, the developer need not wait for operation completion as an event is fired whether or not the operation succeeds. This technology allows for leveraging the ability of Windows 95/98 or Windows NT to run multiple threads of execution. RDO is also thread-safe so it is suitable for use in multiple-threaded headless components executed on a remote server. RDO also suitable when working with SQL Server, Oracle or any relational database that is exposed within ODBC driver regardless of its ODBC compliance level.

2.11.2 Advance Data Object (ADO)

ADO is a technology that can be used by Web page developers to add database access to their online content. Database access opens up a world of information that can be used to customize Web site offerings based on user preferences, past usage history, or up-to-the-minute news. Database applications, with ADO, can be written as online applications, accessed anywhere over the global Internet.

ADO is a technology meant for application and Web-site developers with modest programming skills. It is capable of condensing otherwise complex and lengthy programming tasks into simple-to-use statements and strong enough to grow as the demand for more advanced features. ADO makes both common and advanced operations simpler to use than ever before.

Some of the significant advantages of ADO include:

- ADO is consistent, no matter what database program is actually used to store the information.
- ADO is a cross language. This means that besides being consistent across multiple database vendors, ADO is also consistent across any programming environment, from Visual Basic to C++ to Java.

ADO is available today on platforms used. Active Data Objects are accessible on any operating system that supports both the Component Object Model (COM) and OLE Automation. This include Windows 95/98, Windows NT Workstation, and Windows NT Server running on Intel, DEC Alpha, PowerPC, in addition to any platform governed by Microsoft's Active Platform product line. Online applications can be built by using ADO on the server to deliver customized content through the World Wide Web. In this way, any platform supporting a modern Web browser can automatically take advantage of data access. Users of Windows PCs,

Macs, UNIX Workstation, or other types of consumer Web devices can easily tap into particular online application to make inquiries and order products.

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CHAPTER III

SYSTEM ANALYSIS

CHAPTER 3: SYSTEM ANALYSIS

3.1 ANALYSIS OF THE SYSTEM

Studies on the existing examination system in the market and in the Internet have been carried out in order to get an overview of the system to be built.

Studies on other existing examination processing system either in the market or in the Internet, can basically give some ideas on the usual information displayed in the Internet and the features used in the applications. Different examination processing system will require different features and functions.

Interview with the students and examination administrator have also been carried out. This is the most important step in developing an Agent for Exam Processing system by discussing the feasibility, availability and reliability of the system. Besides, it can obtain the basic requirements and expectations from the students and lecturers, to fulfill the needs of the end users.

At the end of the analysis, the conclusion is to take a combination of ideas and information obtained to build the system. The conclusion will help to analyze the frequently used functions and most effective approach.

3.2 DEVELOPMENT TOOLS ANALYSIS

An analysis was carried out on the development tools for the system. After reviewing and analyzing the requirements, the tools for developing the system have been decided. These tools include the entire platform,

servers, development software and programming languages. Besides considering the suitability of the tools to the requirements, the tools used must be able to support each other. The following session explains all the tools used in the system.

3.2.1 Operating System

3.2.1.1 Microsoft Windows NT Server

Windows NT Server is used as the main server operating system. The main reason for using NT file system is its user friendliness and stability features. The NT server provides the NT authentication and files system that can be used in the system's data repository components. Besides, Windows NT offers many benefits over other operating systems. By making use of theses benefits, developer will be able more productive and publish content on the Internet by exploiting various capabilities of Windows NT.

3.2.2 Web Server

3.2.2.1 Microsoft Internet Information Server (IIS)

Microsoft Internet Information Server (IIS) is selected to be the web server for Agent for Exam Processing due to its suitability for medium-size to large sites doing high-volume serving and corporate Web developers looking for ease of use. It is bundle with Windows NT Server, making it really easy to implement even when faced with a limited budget.

The IIS supports SSL 3.0, which provides a secure communications channel between a browser and server. A security advantage if the IIS is that it allows the administrator to control password length, uniqueness, and how often a password must be changed. This Web server can even disable a password if it is typed incorrectly a specified number of times. It is the only Web server with this feature.

3.2.2.2 Microsoft Exchange Server

Microsoft Exchange Server is also been selected because it is needed to send group e-mail and messages. With unlimited storage capacity, built-in SMP support, improved backup performance, and enhanced security management; Microsoft Exchange Server is best choice for messaging foundation.

3.2.3 Web Database

3.2.3.1 Microsoft SQL Server 7.0

The Agent for Exam Processing's database will be developed using Microsoft SQL Server 7.0. SOL Server is chosen because it can handle a large amount of data with maximum hold up 32,767 databases. Compared with Microsoft Access, it has relatively higher data storage capacity. On the other hand, the Agent will be designed to have a relational database as provided by Microsoft SQL Server.

3.2.4 Web Client

3.2.4.1 Microsoft Internet Explorer

Microsoft Internet Explorer 4.0 or above is selected as the browser to be used in the Agent. It supports most of the scripts, and most importantly, could support ActiveX controls. Netscape Communicator is not under the Agent's consideration because it cannot interpret VBScript that is the main scripting language used in Agent for Exam Processing.

3.2.5 Programming Technologies and Language

3.2.5.1 Active Server Pages

Active Server Pages is the script that runs in the Microsoft Web server. Its function is to generate HTML scripts for the client browser. Compared to CGI, ASP is easier to be used and is more flexible in changing codes as no compilation is involved. It is, therefore, selected as the main development tools for the server run script.

3.2.5.2 Hypertext Markup Language (HTML)

In order to develop a web-based application, the HTML script is needed. HTML is the basic tool that is necessary for the development of client's browser run script.

3.2.5.3 VBScript

Besides HTML, VBScript is another selected tool for the development of client's browser run script. Its function is to make the web application

more dynamic. Although VBScript is still new if compared to JavaScript, however, proved more reliable in working with ASP.

3.2.6 Web Application Development Tools

3.2.6.1 Microsoft Visual Interdev and Notepad

Notepad and Microsoft Visual InterDev becomes the editor for the ASP coding in the Agent. The use of Notepad as an editor is not as good as Microsoft Visual InterDev, which provides more features that are helpful for ASP coding. Notepad, however, is available in most on the Windows workstations.

3.2.7 Database Connectivity

3.2.7.1 Advance Data Object (ADO)

Database connectivity used in the Agent is Advance Data object (ADO). ASP uses ADO to access the database. ADO provides critical features that are needed to transform existing client-server application into Web-enabled applications. The ADO object supports various cursor types, batch updating, extended record set management techniques, and advanced stored procedure support.

3.3 REQUIREMENT ANALYSIS

Requirement analysis enables the system engineer to specify software elements, and establishes design constraints that the software must meet. A complete understanding of software requirements is essentials to the success of a software development effort. No matter how well designed or well coded, a poorly analyzed and specified program will disappoint the user and bring grief to the developer.

3.3.1 Functional Requirements

As stated in Chapter 1, Agent for Exam Processing is divided into three sections, which are Administrator Section, Student Section and Lecturer Section. Each of the section will have its own module that performs different function and task.

3.3.1.1 Administrator Section

Administrator Section is divided into six main modules, namely Change Password Module, Student Module, Lecturer Module, Record Management Module, Record Summary Module and Rule Management Module.

- Change Password Module
  This module enables administrators to change the administrator, lecturers and students password.

- Student Module
  Student module summarizes all the registered students that are authenticated to use the agent. The module enables administrative staffs to add new student, edit their profiles and delete existing students. It gives the function to view all students

or search by matric number, by lecturer or by major and sort the student list by name or by matric number. Another sub-module in this section is to give the administrative staffs the authority to change the student's course registration.

- Lecturer Module

  Just like Student Module, the lecturer module summarizes all the registered lecturers that are authenticated to use the agent. The module enables administrative staffs to add, edit and delete lecturer's information. In addition to that, this module provides a feature to assign course handled by the lecturer on a particular semester. Each course can only be assigned to a lecturer.

- Record Management Module

  In this module, administrators are able to add, edit and delete record in the database. It could be adding a new semester, new course, editing the marks for a subject to deleting the entire course from the database. This module is implemented throughout the whole system where database connectivity is concerned. For example, to change the lecturer for a certain subject, administrators would retrieve the subject's information and choose another lecturer from the menu. Subsequently the lecturer's ID will be stored in the database as a lecturer for that course.

- Record Summary Module

  In order to simplify the task of viewing vast records of marks, the Agent is equipped with summary generating module. Its function is to come out with summarized records and statistics to assist administrators in record analysis. The sub-modules here are View by Statistics, View Lecturers & Students and Summary of Courses by Semester. Most of the data are viewed in the form of table and graphs.

- Rule Management Module

  As a rule-based system, most of the decisions made by the Agent are based on fixed rules set by the developer. In order to insert new rules, edit or eliminating existing rules, administrators have the privilege to do so by accessing this module. It comes with a help file to guide administrators on writing new rules, editing existing rules and setting the place of implementation of the rule.

3.3.1.2 Lecturer Section

The five main modules in Lecturer Section include Course Management Module, Result Analysis Module, Change Password Module and View Student Module.

- Course Management Module

  This module enables lecturers to key in their students' test, assignment, quiz and exam results. The lecturer could only add or edit the data according to the course assigned to him or her. Besides that, lecturers need to assign the weight for the test, assignment, quiz and exam results so the Agent could compute the result and produce a remarkable statistic.

- Result Analysis Module

  In this module, lecturers could view the result analysis after keying in the marks for a certain course. Summary is presented in a table form and a dynamic bar chart, which shows the average points for the course, the highest and lowest marks, and the list of students with their grades.

- Change Password Module
  This is the simplest module for lecturers who wish to change their password. All they have to do is key in their old password and the new password. The Agent will verify the old password with the one stored in the database. If it matches, then the new password will automatically be stored in the database.

- View Student Module
  As said earlier, each lecturer is assigned as an advisor to a few students. The function of this module is to monitor the performance of these students. Advisors could view students' information by the course they take, number of credit hours per semester and their estimated CGPA. If the students' result has a drastic change the Agent will alert the advisor to take actions.

3.3.1.3 Student Section

There are five main modules in Student Section that is Change Password Module, View Result Module, View Performance Module, View Graduation Path Module and Course Registration Module.

- Change Password Module
  This is the simplest module, a replica of Change Password Module in Lecturer Section.

- View Result Module
  Here, students are only allowed to view their final results. A list of courses taken by the student will be listed out and only the final result will be displayed. There is an option for the student to view their test, quiz and assignments result provided if their lecturer authorizes the rule to do so.

- View Performance Module

  In this module, students could see their performance in graphical view, which shows the GPA for every semester until the student graduate. It could also calculate the GPA to be achieved if the student wants to have a better result in the next semester.

- View Graduation Path Module

  By keeping track the course taken by the student, the Agent is able to determine the time period and path to graduation for the student. If a student is not able to pass certain core course, then he or she will not be allowed to take the following courses, which has prerequisite of the core course.

- Course Registration Module

  After the final results are out, students are allowed to register for the courses for the coming semester. This is feasible provided the administrator would assign the courses offered for the coming semester.

3.3.2 Non-functional Requirements

Despite a set of functional requirements, the Agent also includes some non-functional requirements. Non-functional requirements are defined as constraints under which the system must operate and the standard, which must be met by the delivered system. These requirements are very subjective but are as important as the functional requirements.

3.3.2.1 Inter-operability

Applications and computers from different suppliers will have the capability to work together on a network and to connect to each other, share data and processes as appropriate.

3.3.2.2 Scalability

The scalability is to promise the capability of the system to migrate as a client or server to machines of greater or lesser power, depending upon requirements, with little or no change to the underlying components. The solution can be scaled using hardware or application configuration or a combination of them.

3.3.2.3 Portability

The solution must make ensure the capability of the application system to operate on various platforms regardless of manufacturer or operating system. This is important to identify the portability of the components in operating on various platforms by either without any modification, recompiling, reconfiguration or redesign of the components.

3.3.2.4 Reliability

A system is said to have reliability if it does not produce dangerous or costly failures when it is used in a reasonable manner, that is, in a manner that a typical user expects is normal. This definition recognizes that a system may not always be used in the ways that the designer expects.

3.3.2.5 Security

Users must login with their username and password to prevent unauthorized access into the administrator, student and lecturer section.

3.4 RUN TIME REQUIREMENTS

3.4.1 Server Hardware Requirements

The server computer requirements are:

- A server with at least Pentium 266Mhz processor
- At least 32 MB RAM
- Network Interface Card (NIC) and network connection with recommended bandwidth at 10Mbps or more
- Other standard computer peripherals

3.4.2 Server Software Requirements

To host and run the system, the server computer needs to have various supporting software installed:

- Windows NT Server 4.0 - Network operating system
- Microsoft Internet Information Server 4.0 - Web server service
- Microsoft Exchange Server 5.5 - Web server service
- Active Server Pages - Server scripting engine
- Microsoft SQL Server 7.0 - Database server

3.4.3 Client Hardware Requirements

The client hardware requirements are quite minimal as long as it has a reasonable amount of RAM. The recommended amount of RAM is 64 MB.

3.4.4 Client Software Requirements

The client software requirements fall on the browser used by users. It requires a system that can run Microsoft Internet Explorer 4.0 or above or any other browsers that support VBScript.

CHAPTER IV

SYSTEM DESIGN

CHAPTER IV: SYSTEM DESIGN

Design phase is the stage of system development where the requirement for the system that was gathered from system analysis is translated into the system characteristics.

4.1 OVERVIEW OF AGENT FOR EXAM PROCESSING STRUCTURE

Agent for Exam Processing uses dynamic web pages in system design. Dynamic web pages are those pages that provide true user interaction. In this model, users interact through the use of server-side programs that provide for an enhanced experience. Dynamic web pages support the building of true interactive applications such as Agent for Exam Processing. Dynamic web pages provide a world of new possibilities over static pages.

Microsoft Visual InterDev also support the use of Active Server Pages (ASP). ASP is a feature included with Internet Information Server 4.0. It provides a framework for creating dynamic web pages. ASP is based on the ActiveX Scripting engine that enables the system to include server-side executable script directly into HTML document. Agent for Exam Processing creates Active Server Pages using popular scripting languages, such as VBScript.

In conforming to the overall system design, the Agent for Exam Processing system is designed to be a three-tier architecture, which is believed to be more loosely coupled design for the components used.

In Agent for Exam Processing design, the frontier tier is the presentation / application tier, which is an Internet browse and is used to present the

human interactive interface to the user. HTML and VBScript are used to provide the most flexible and dynamic interface for the users.

The middle tier is known as the functionality / service tier. The communication between this tier and the frontier tier depends on the Hypertext Transfer Protocol (HTTP) for the web pages transfer. The back end processing that happens in this tier supports the functions provided in the presentation tier. The functionality / services tier consists of some components that are created to support the Agent functions such as keying in results, results analysis and so on. All the components require ASP and some active server object to perform the functions in the web server.

The bottom tier is data repository, which is for database management. The database is connected to the components through the combination of SQL and ODBC.

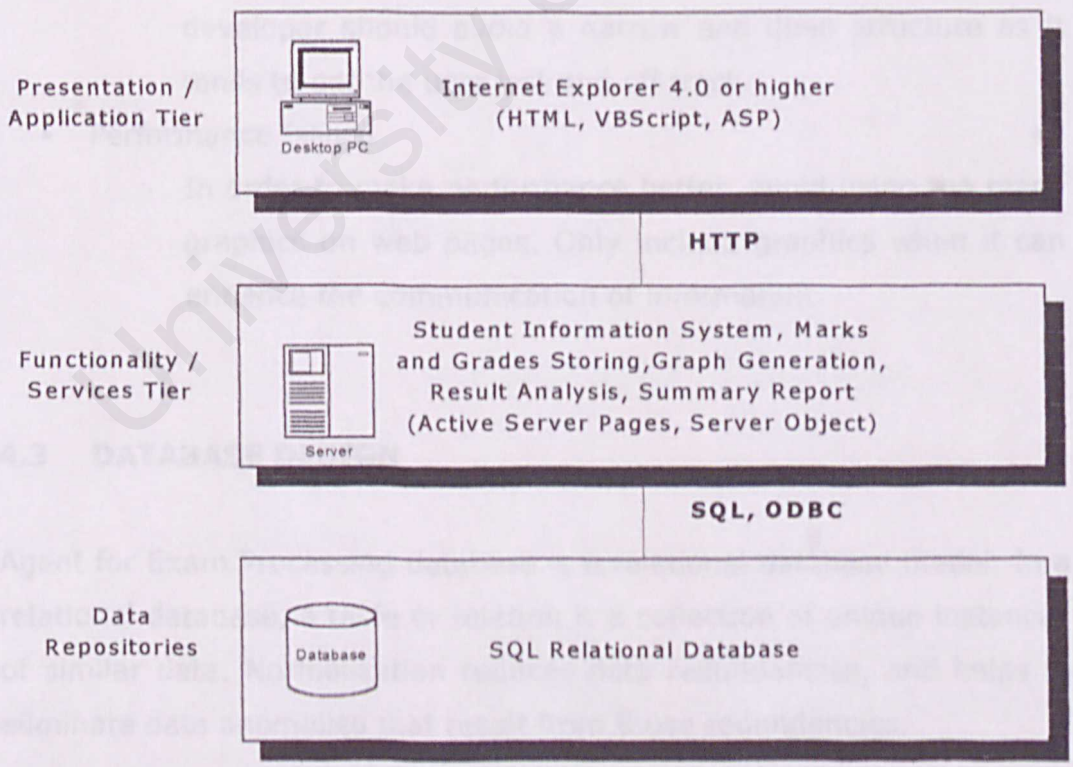

Figure 4.1: Agent for Exam Processing Tier-to-Tier Architecture

4.2 USER INTERFACE DESIGN

User interface design is one of the most important aspects of Agent for Exam Processing development process. The following are some of the considerations taken while designing the user interface for web pages. They are:

- Ease of use
  - Use different background ranging from GIFs to solid colors to make the web pages more attractive.
- Consistency
  - Consistency brings a sense of identity to web pages. Users can find information faster when they are familiar with particular web page layout.
- Navigation
  - The hierarchical organization of web pages should allow for simple and intuitive navigation between pages but developer should avoid a narrow and deep structure as it tends to get the user lost and off track.
- Performance Issues
  - In order to make performance better, avoid using too many graphics on web pages. Only include graphics when it can enhance the communication of information.

4.3 DATABASE DESIGN

Agent for Exam Processing database is a relational database model. In a relational database, a table or relation is a collection of unique instances of similar data. Normalization reduces data redundancies, and helps to eliminate data anomalies that result from those redundancies.

4.3.1 Database Structure

Microsoft SQL Server 7.0 is used as the main database platform in this project. The database was connected to the web application by using Microsoft's ODBC Data Source Administrator. The following figure illustrates the mapping of the SQL Server database to the applications via ODBC (*Open Database Connectivity*). As such, the applications can always access to the database even they are not in the same machine.

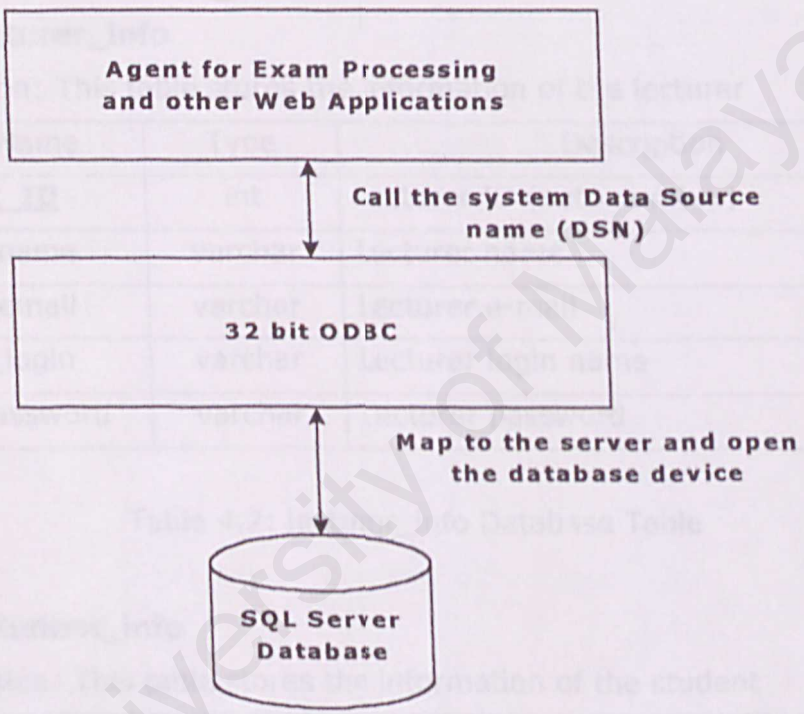

Figure 4.2: The Mapping of Database to Application

4.3.2 Data Dictionary

The followings are the dictionary that explains the item and fields of the data. The primary key of the table is represented by **bold** and underlined text (e.g. **admin_ID**).

1. admin_info

Description: This table stores the information of the administrator.

Field Name	Type	Description
admin_ID	int	Administrator ID (auto number)
admin_name	varchar	Administrator login name
admin_password	varchar	Administrator password

Table 4.1: admin_info Database Table

2. lecturer_info

Description: This table stores the information of the lecturer

Field Name	Type	Description
lect_ID	int	Lecturer ID (auto number)
lect_name	varchar	Lecturer name
lect_email	varchar	Lecturer e-mail
lect_login	varchar	Lecturer login name
lect_password	varchar	Lecturer password

Table 4.2: lecturer_info Database Table

3. student_info

Description: This table stores the information of the student

Field Name	Type	Description
stud_ID	int	Student ID (auto number)
stud_matric	varchar	Student's matric number
stud_name	varchar	Student's name
stud_email	varchar	Student's email
stud_login	varchar	Student's login name
stud_password	varchar	Student's password
stud_major	varchar	Student's major
stud_advisor	int	Student's advisor
stud_race	varchar	Student's race

stud_gender	varchar	Student's gender

Table 4.3: student_info Database Table

4. fsktm_course

Description: This table stores the information of all the courses of FSKTM

Field Name	Type	Description
course_ID	int	Course ID (auto number)
course_name	varchar	Name of the course
course_code1	varchar	The code of the course
course_code2	varchar	Alternative course code
course_code3	varchar	Alternative course code
course_code4	varchar	Alternative course code
course_code5	varchar	Alternative course code
course_code6	varchar	Alternative course code
lect_ID	int	Lecturer's ID
taken	bit	Status of the course (1/0)
credit	int	Credit hours for course

Table 4.4: fsktm_course Database Table

5. registration

Description: This table stores the information of courses registered by students

Field Name	Type	Description
reg_ID	int	Registration ID (auto number)
course_ID	int	Course ID
lect_ID	int	Lecturer ID
session_ID	int	Session ID

Table 4.5: registration Database Table

6. marks_allocation

Description: This table stores the information for allocating marks

Field Name	Type	Description
course_ID	int	Course ID
mark1	int	Marks allocated for test
mark2	int	Marks allocated for quiz
mark3	int	Marks allocated for assignments
mark4	int	Marks allocated for final exam

Table 4.6: marks_allocation Database Table

7. course_info

Description: This table stores the information for marks collected by student

Field Name	Type	Description
ID	int	Number (auto number)
reg_ID	int	Registration ID
stud_ID	int	Student's ID
mark1	int	Marks for test
mark2	int	Marks for quiz
mark3	int	Marks for assignment
mark4	int	Marks for final exam
average	varchar	Average Marks
grade	varchar	Grade

Table 4.7: course_info Database Table

8. grading

Description: This table is used to store information of grading point

Field Name	Type	Description
Grading_ID	int	Grading ID (auto number)

point1	int	Lowest score for grade
point2	int	Highest score for grade
grade	int	Grade
points	varchar	Credit Points for grade

Table 4.8: grading Database Table

9. rules

Description: This table is used to store information on rules

Field Name	Type	Description
rule_ID	int	Rule ID (auto number)
rule	varchar	Rules
activation	bit	Control activation of rule

Table 4.9: rules Database Table

10. session

Description: This table is used to store the session

Field Name	Type	Description
session_ID	int	Session ID (auto number)
session	varchar	The session (e.g. 2000/2001)
semester	varchar	The semester (e.g. I/II)

Table 4.10: session Database Table

11. graph2

Description: This table is used to store the information for dynamic graph

Field Name	Type	Description
Grade	varchar	Grade Allocated
TotalStud	int	Total Students for that grade

Table 4.11: graph2 Database Table

4.3.3 Relationship

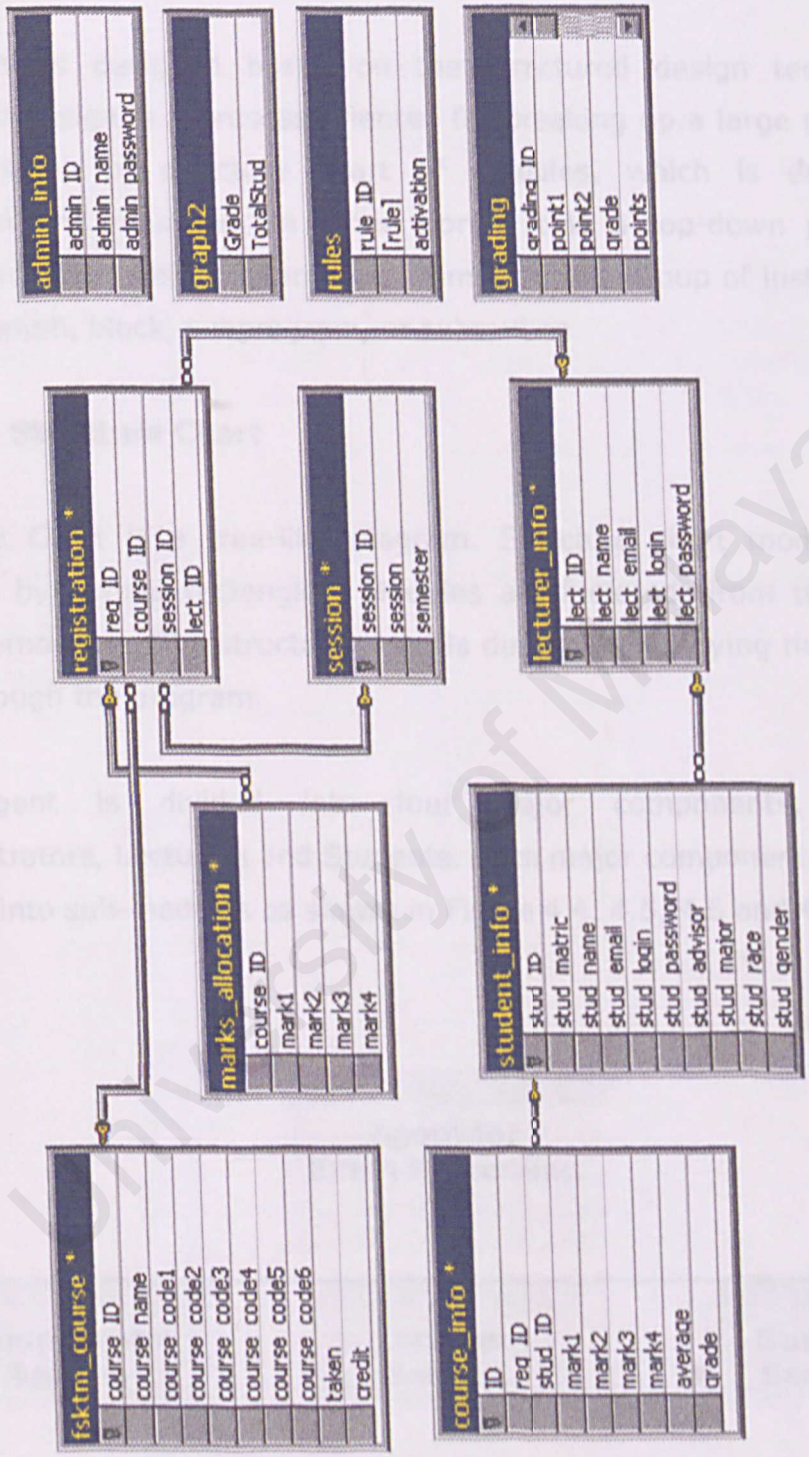

Figure 4.3: Relationship

4.4 PROCESS DESIGN

The Agent is designed based on the structured design technique. Structured design is a process oriented for breaking up a large program into hierarchy of structure chart of modules, which is easier to implement and maintain. In other words, it is a top-down program design and structured programming. A module is a group of instructions – a paragraph, block, subprogram, or subroutine.

4.4.1 Structure Chart

Structure Chart is a tree-like diagram. Structure chart modules are depicted by named rectangles. Modules are factored, from top-down, into sub-modules. The structure chart is derived by studying the flow of data through the program.

The Agent is divided into four major components, Access, Administrators, Lecturers and Students. Each major component is further divided into sub-modules as shown in Figure 4.4, 4.5, 4.6 and 4.7.

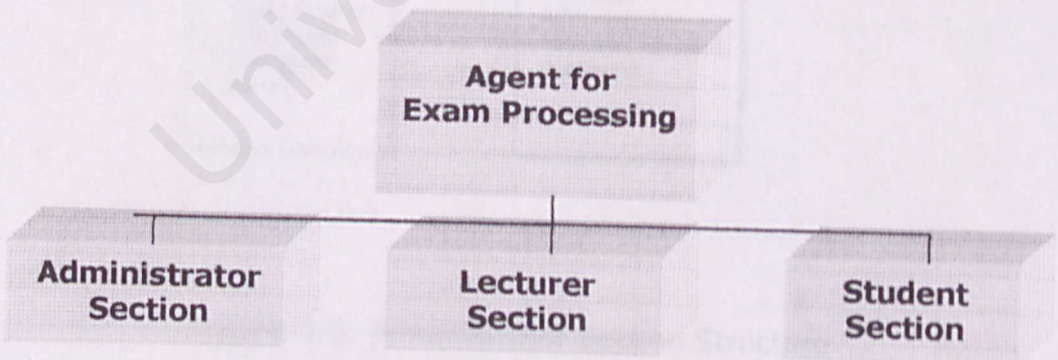

Figure 4.4: Main Structure Chart

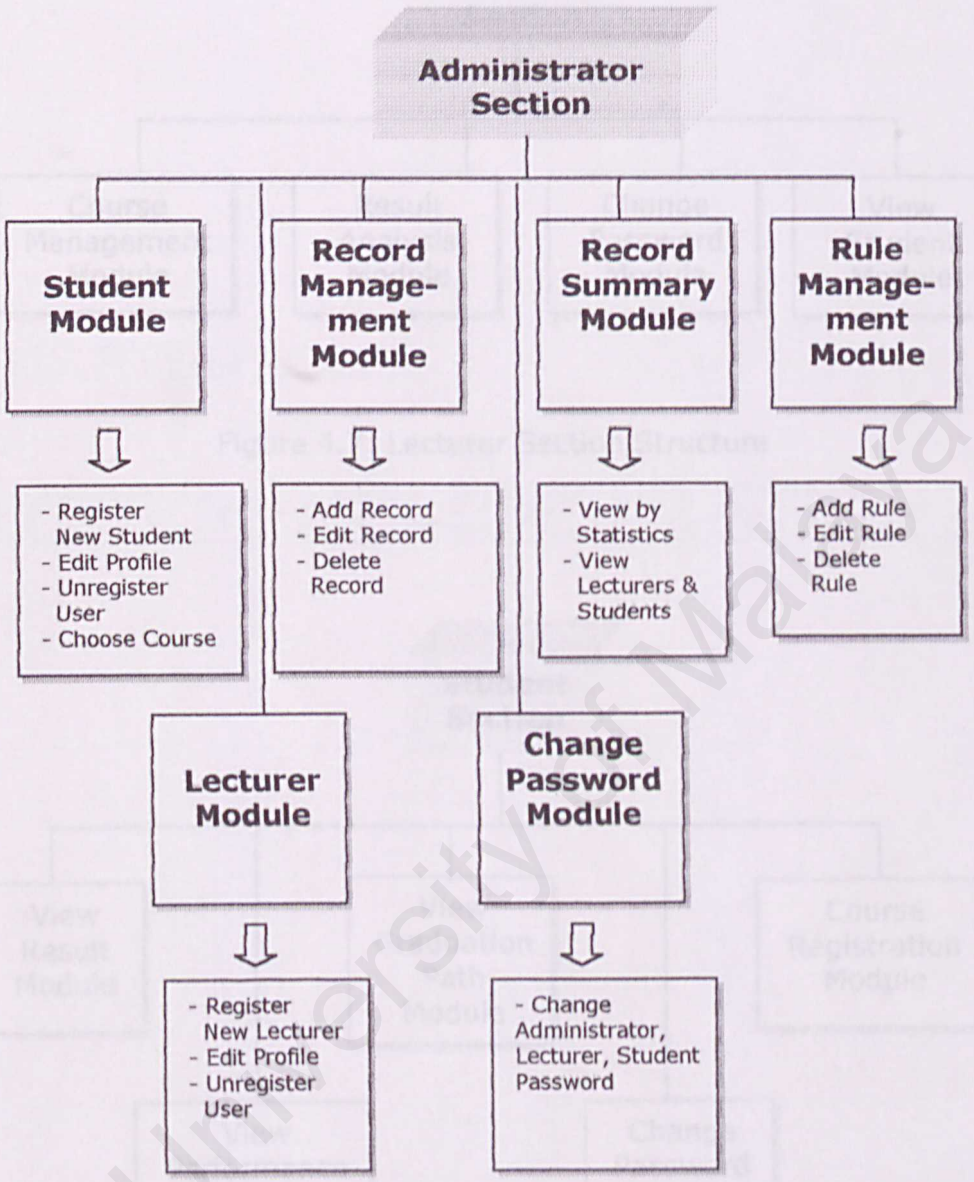

Figure 4.6: Administrator Section Structure

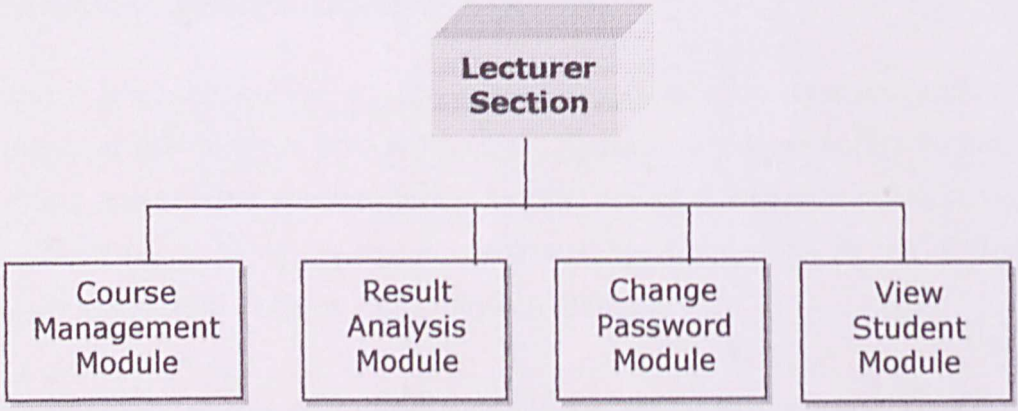

Figure 4.7: Lecturer Section Structure

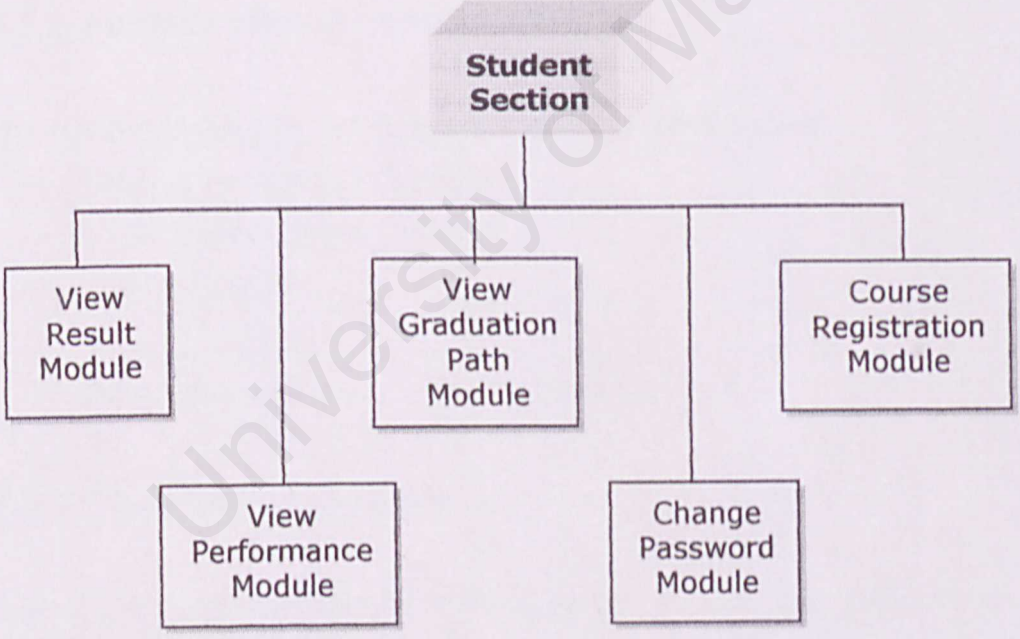

Figure 4.8: Student Section Structure

CHAPTER V

SYSTEM IMPLEMENTATION

CHAPTER V: SYSTEM IMPLEMENTATION

System implementation is the construction of the system and the delivery of that system into production. System implementation includes building and testing system, which is also called the construction phase. Construction phase of the system involves the conversion of the system requirements and designs into program codes.

The Agent is developed modularly using top-down approach, which involves building the high-level software modules that are refined further into functions and procedures.

5.1 DEVELOPMENT ENVIRONMENT

5.1.1 Hardware Requirement

The hardware used to develop the Agent are listed below:

- 266Mhz PentiumII Processor
- 512K Pipeline Burst Cache
- 128MB SDRAM
- 13 GB Hard Disk
- Other standard desktop PC components

5.1.2 Platform Development

Before the Agent development could be carried out, the platform has to be first established. As the design of the system is a tier-to-tier architecture, the components used must be able to support each other. The setting up of the entire platform was difficult and time consuming as it involves many components in the system.

5.1.3 System User Environment

The first step in setting up the platform was installing the server operating system into the necessary servers or computer. This process included formatting the disk to be NT File System format (NTFS). The NTFS format was chosen rather than the normal FAT system because NTFS can provide a more stable and secured NT transaction across the platform. After that, the NT Server with Option Pack 4.0 was installed into the disk. During the installation, a domain name was given to the server domain.

5.1.4 Web Accessible System

A web server is needed for the entire Agent. Internet Information System (IIS) is selected as the web server for the entire system.

IIS 4.0 was installed through the installation of the Option Pack 4.0. Through the IIS manager, a virtual directory was created for the web access to the Agent system. Therefore, the system could be accessed with the following address from the browser:

Agent system : http://**ServerName**/agent/...

5.1.5 System With Database

The SQL Database was set up to keep data for the Agent. In the created storage, all the 11 tables as mentioned in section 4.3.2 were created to keep data used in all modules of the Agent.

In order to map the database to the web server, a system Data Source Name (DSN) was created for the Agent database storage. In this case, a DSN was registered through the ODBC in the web in the web server

machine. The ODBC could map to the storage even if they are situated in different machines. Likewise, the web server could open the database storage by just calling the DSN.

5.1.6 Software Tools for Agent Development

Table 5.1 below depicts all the software used to develop the Agent.

Software	Module	Description
Microsoft NT Server 4.0	System Requirement	Operating System
Microsoft Internet Information Server 4.0	System Requirement	Web Server Host
Microsoft SQL Server 7.0	Database	Build the database to store and manipulate data
Microsoft Visual InterDev 6.0	System Development	Web Page Coding, ASP and HTML, Layout Design
Microsoft Internet Explorer 5.0	System Development	Web Client – Web Page Viewing
Notepad	Interface Design	HTML Design
Adobe Photoshop 5.0	Interface Design	Image and background design
Microsoft Word 2000	Report Writing	Writing Document and Report

Table 5.1: Summary of Software Tools Used

5.2 DEVELOPMENT OF THE AGENT

5.2.1 Microsoft Visual InterDev 6.0

At the initial stage of development phase, developers are required to create a web project for the system using Visual InterDev 6.0. The Agent appropriately use some of the Visual InterDev 6.0 features and technologies in creating, editing, deploying and managing its web site. Visual InterDev 6.0 combines a rich set of database connectivity tools, wizards, and design-time controls to increase the functionality and decrease the development time to build Active Server Applications. Some of the features of Visual InterDev 6.0 are listed below:

- RAD Environment
  The new IDE provides a complete set of rapid application development (RAD) tools to let professional developer design, build, debug and deploy data-driven web application faster than before. These include: source code preserving WYSIWYG page editor with full support for dynamic HTML, complete and end-to-end debugging tools for both client and server side code as well as site design and management tools.

- Integrated Database Tools
  Visual InterDev 6.0 provides a complete set of tools for integrating databases with dynamic web application. Database features include drag and drop blinding of database to HTML forms and reports, database design tools for creating and modifying SQL Server databases.

- Improved Web Application Programming Model
  Visual InterDev 6.0 simplifies the inherent complexities of building web application by providing an intuitive programming model,

which includes: Object-based and event driven programming, simple consistent programming model for both broad-reach and dynamic HTML-based application.

5.2.2 Web-pages Development

The Agent for Exam Processing is classified as web application. Most of the web pages in the system are dynamically generated, where page information are gathered from database server. However, there are still some static pages for information display purposes. All web pages are coded into ASP document before being presented to the browser. ASP uses VBScript to convert coded processing logic into native HTML. The pure HTML output is then accessible by any HTML-compatible browser.

VBScript, which is the foundation of ASP, is used for server-side execution in the Agent. Active Server scripts are distinguished from HTML tags and normal content by using the <% and %> delimiters.

However, for client-side scripting, they must be delimited by <Script>...</Script>. For example, VBScript is used in the Agent to pre-check submitted forms before transmitting them to the server. This reduces the connection overhead, as well as making field validation immediate instead of having to wait for the server to parse the form, validate the data, and generate a response document.

System development involves endless cycle of coding, testing and modifying the source code. Testing is done by previewing in browser using Microsoft Visual InterDev or opening the particular ASP page using Microsoft Internet Explorer.

Besides, Adobe Photoshop 5.0 was used for beautifying the web pages. It was used for developing and editing images.

5.3 SYSTEM TESTING

In a corporate world, many types of tests are done on particular system before the system can be released to the user with confidence that the system will work properly. Testing will help to uncover logic errors and make sure the system conform tot he requirements specified.

5.3.1 Unit Testing

In developing a large system, testing usually involves several stages. Unit testing, which is also called module testing, or component testing verifies that the component functions properly with the types of input expected.

Unit testing is done in a controlled environment whenever possible, so that the developer can feed a predetermined set of data to component being tested and observe what output actions and data are produced. In addition, the test team checks the internal data structures, logic and boundary conditions for input and other data. The following sections explain those testing strategies that were carried out throughout the development of the Agent.

5.3.1.1 Review / Examining the code

One of the basic and important testing strategies is code reviewing. The code was reviewed by the developer.

In reviewing the code, the correctness of coding was to be reviewed and identified by comparing it to the original design of the program flow at all time. When the logic and flow of the program were identified, the code was commented so that it can be traced in the future.

The code was also examined and debugged in order to identify any fault coding. Coding with ASP was difficult as there were no proper ASP debugger and tester used in the project. The examination and debugging of ASP code was worked out by adding a "watch" line in the code. For example, in this following code:

```
<%
        If paperdate = todaydate Then
            gotpaper = True
        End If
%>
```

The above code can be debugged in such a way:

```
<%
        Response.Write (todaydate) 'print out the date
        If paperdate = todaydate Then
        'print out this line to indicate that the program is in the If ..
        Else condition
            Response.Write ("In Block")
            gotpaper = True
        End If
%>
```

By using the Response.Write, a value can be printed on the browser. Hence, it was used as the "watch" that the value of a variable and the flow of the program could be clearly seen.

5.3.1.2 Testing Program with Test Cases

There should be a more practical strategy in order to identify the variance between the prototype and the requirement. Therefore, the program has to be tested with some test cases. The test cases used in the project were a set of structural input to test the program.

In this testing, it involves the input of different data to the program. The test data was the data that would be most often used by the user. With this, the reaction of the program to the input data could be tested. This could identify the program's faults, which probably happen in normal condition.

5.3.2 Integration Testing

When all the modules were believed to have satisfied the requirements, they were integrated with the main system. During the integration, the testing was also carried out in order to meet the following objectives:
Identify the fault and failure cased by the integration
Review and rectify the correct path of the system flow
Compare the integrated system with the functional and non-functional requirements specification

As the development of the Agent is divided into modules development and then only to be integrated with the Agent foundation, the integration testing applied the sandwich approach testing. In this testing approach, each module was first tested individually. They were then combined and tested together.

During the integration, all the module prototypes were combined and tested in a testing environment. The testing environment was consistent for all modules in terms if interface, user authentication and function called procedures. To do this, the program flow and testing needs for each of the modules were reviewed and identified. After identifying the testing requirements for the integration, the program flow of the entire system were reviewed and tested. When all the modules were integrated, the entire system was tested with some test cases.

CHAPTER VI

EVALUATION & CONCLUSION

CHAPTER VI: CONCLUSION

6.1 PROBLEMS ENCOUNTERED AND SOLUTIONS

Problems arises are the substance to be encountered in every project. A project without encountering any problems would be perfect and no improvements could be made to it. In developing the Agent for Exam Processing, several problems crop up along the way.

6.1.1 Lack of Knowledge on Web-Based Programming

I would classify this as the major problem because I only have a limited knowledge on programming using Active Server Pages. Programming a web-based system is very much different from developing a normal conventional program. The new exposure to ActiveX, Windows NT Server, Internet Information Server, SQL and ODBC gave me a huge inspiration to learn more of it while I am doing the Agent's coding.

6.1.2 Lack of Knowledge on Programming an Intelligent System

In this area, the setback is to define a number of rules for the system. As a rule-based system, the Agent runs on two major parts, which are the Knowledge Base and the Inference Engine. Knowledge Base is represented by the database that stores all the data, information and even rules. The rules have to be programmed, as it will be fired when necessary. Adding additional rules to the system and putting it to use proves to be another major hinder for me.

6.1.3 Difficulty in choosing development technology, programming languages and tools

Many methods could be implemented in developing a web-based intelligent system. Choosing the suitable technology, programming languages and tools proved to be a difficult task as all tools has its strengths and weaknesses. Furthermore, the availability of the tools for development is also a major dilemma.

6.1.4 Difficulty in setting up the server and platform

It takes up a lot of time due to new exposure to new technology and lack of experience in setting up the server and platform. The major problem occurs while doing configuration to the server during setup.

In this sector, my seniors have made a lot of contributions in helping me. They have more experience in setting up servers and platforms as they are in this line of business.

6.2 SYSTEM EVALUATION

6.2.1 System Strengths

- User Friendly Interface

  The Agent for Exam Processing has been designed to suit the users preferences. Its interface is simple and user friendly with help guide on every page. With the help of menus, icons and guides, users are expected to master the system flow in minutes.

- System Security

  The Agent is equipped with a best possible level of security to prevent any unwanted guests. Administrators, lecturers and students have their own unique login name and password to view they system. Besides that, all the data transferred in the system including mail will be encrypted before sending to avoid information leak.

- System Transparency

  The users would not know how the whole system works as ASP programming would display the interface as HTML coding. The system structure, backend processing where databases are involved would not be accessible to the users.

- Validation on Input Data

  The Agent is programmed to detect faults in data input by users. It will detect any invalid input and perform system halts until the user key in a valid input.

- Automatically analyze result and generate report

  In the backend processing, the Inference Engine will automatically read the data from the database, analyze the result and generate a report. All these are done using ASP coding.

- Implementing New Rules

  The system is programmed to be able to receive and understand new rules keyed in by the administrators.

- Faults Detection

  Faults detection refers to any error in applying new rules to the system. Other than that, the system also detects any unusual changes in the grades of students during result analysis.

- Online Help File

  Help file would be accessible in every page to provide more information to the users.

6.2.2 System Weaknesses

- Limited Users

  Currently only the faculty's administrators, lecturers and students are able to utilize this system. It would very much depend on the users' acceptance of the system before it could be widely distributed to other faculties or even to Universiti Malaya's administrators.

- Result Analysis

  The analyzed results are represented in normal table and graphs. More interesting method could be used to make the Agent more user-friendly and interesting to use.

- New Rules Implementation

  This is a new method introduced to me, which I have never done before. At present, the administrators need to type in the whole rule as shown in a given example on the web page. Rules are only allowed to be keyed-in in the ASP format. Therefore, it is not very flexible for experts like PROLOG programmers.

- Mail Server Issue

  At the moment, the Agent is unable to get any mail server. Therefore, users will have to use other alternatives like Microsoft Outlook to do the mailing.

6.2.3 Future Enhancement

A system development knows no boundaries as new requirement and better implementation methods continue to arise and evolve. The Agent could be improved further by incorporating more functionality. A summary of the enhancement on system functionality is provided int he following sections.

- Browser Independent
  In future, The Agent should be able to support various types of Browser and not only limited to Microsoft Internet Explorer.

- Mail Server Issue
  The integration of mail server into the Agent is recommended. Mail Server such as Microsoft Exchange Server enables the administrator to create an email account for student and lecturer who have no email account.

- Result Analysis
  Future version of the Agent should be able to display the analyzed in data in various charts such as pie chart, line chart and so on.

- User Interface
  The user interface of the Agent is quite plain and might not be attractive enough to certain group of people. Adding in more graphics or animation images can make the Agent look user-friendlier.

- Connection and Data Security
  The Agent should improve the connection and data security such as using Socket Secure Layer for the connection security,

encryption for important data and using digital signature for authentication purposes.

6.3 CONCLUSION

The project is designed to meet the objective of developing an Agent for Exam Processing for Faculty of Computer Science and Information Technology, Universiti Malaya. This intelligent system, which I believe to be among the few intelligent systems developed by undergraduates over the years, would be very useful if its functions are put to full use. Additional features that could be added to this system are like web-based exam papers and marking system.

However, the Agent is limited to FSKTM users only. This constraint is hard to be tailored at the moment due to its limited functions and programmed constants.

Although the coding part would seem to be a major brain-cracker, I am very excited about it after being exposed to all the new technologies and methods. The challenge gave me the feeling of satisfaction and fulfillment after completing such a masterpiece.

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GLOSSARY

GLOSSARY

Active Data Objects (ADO)

A set of object-based data access interfaces optimized for Internet-based, data centric applications. ADO is based on a published specification and ships with Microsoft Internet Information Server and Microsoft Visual InterDev.

Application

A software program or set of programs that uses the computer as a tool, a opposed to the software necessary to run the computer.

Active Server Pages (ASP)

Active Server Pages is an open, Compile-free application environment that enables server-side scripting with native support for both Visual Basic Scripting and Java Script. It is a feature if IIS.

Client/Server Architecture

A model of computing whereby client application running on a desktop or personal computer, access information on remote servers or host computers. The client portion of the application is typically optimized for user interaction, whereas the server portion provides the centralized, multi-user functionality.

Database

A collection of information units containing related information. Each unit is a database record.

E-mail

Or called Electronic mail. Involves sending and receiving messages over the network.

File Transfer Protocol (FTP)

File Transfer Protocol is a protocol for moving files from one computer to another.

Hypertext Markup Language (HTML)

The language used to create conventional Web pages.

Hypertext Transfer Protocol (HTTP)

The native communications scheme of the World Wide Web, initially used to transfer hypertext documents.

Internet

A worldwide system of linked computer networks for data communication services such as World Wide Web and electronic mail.

Internet Information Server (IIS)

Microsoft Internet Information Server (IIS) is an Internet file and application serer included with the Microsoft Windows NT Server operating system.

Intranet

A Web site or series of Web sites that belong to an organization and can be accessed only by the organization's member.

Open Database Connectivity (ODBC)

A vendor-neutral interface, based on the SQL Access Group specifications, announced by the Microsoft in December 1991. A developer can use ODBC to access data in a heterogeneous environment of relational and non-relational databases.

Operating System

Often referred to as "OS". The set of programs that control the computer and it's processing.

Protocol

A set of rules.

Remote Data Object (RDO)

In version 2.0, RDO is a high-level object interface that directly calls ODBC for communication or systems hardware, software or interface.

Server

The computer system that responds to inquiries or transactions in from a client computer.

Structured Query Language (SQL)

The international standard language for defining and accessing relational databases.

Transmission Control Protocol / Internet Protocol (TCP/IP)

The term used to refer to the complete suite of protocols including IP, TCP and the associated application protocols.

Web Browser

A program that interprets Hypertext Markup Language (HTML) and displays information on a computer screen. Using a browser, a person can read hypertext and view graphical images. A person uses a browser to view the contents of network nodes and to navigate among nodes. Popular examples include Microsoft Internet Explorer and Netscape Navigator.

Web Server

A computer that provides Web services and published pages to Intranet and Internet users.

World Wide Web (WWW)

A popular hypertext based system of transmitting textual and multimedia-based information through the Internet.

APPENDIX – USER MANUAL

TABLE OF CONTENTS

LIST OF FIGURES

AGENT FOR EXAM PROCESSING USER MANUAL

1.0 OVERVIEW OF THE AGENT

The system is designed for the Faculty of Computer Science and Information Technology, University of Malaya. The system is divided into three main sections, which are:

- Student Section
- Lecturer Section
- Administrator Section

The Agent is a web-based application. It is advised that to use Internet Explorer 4.0 and above to browse the system. Besides, it is best viewed with 800 x 600 pixels resolution with 16-bit colors.

2.0 MAIN PAGE OF THE AGENT

Figure 2.1: Main page of the Agent for Exam Processing

3.0 SYSTEM REQUIREMENTS

3.1 Hardware

- Pentium Processor (200Mhz and above)
- 512K Pipeline Burst Cache
- 64 MB RAM
- Other Standard PC components

3.2 Software

- Windows 98 or Windows NT
- Microsoft Internet Explorer 4.0 and above

4.0 ADMINISTRATOR SECTION

4.1 Administrator Login

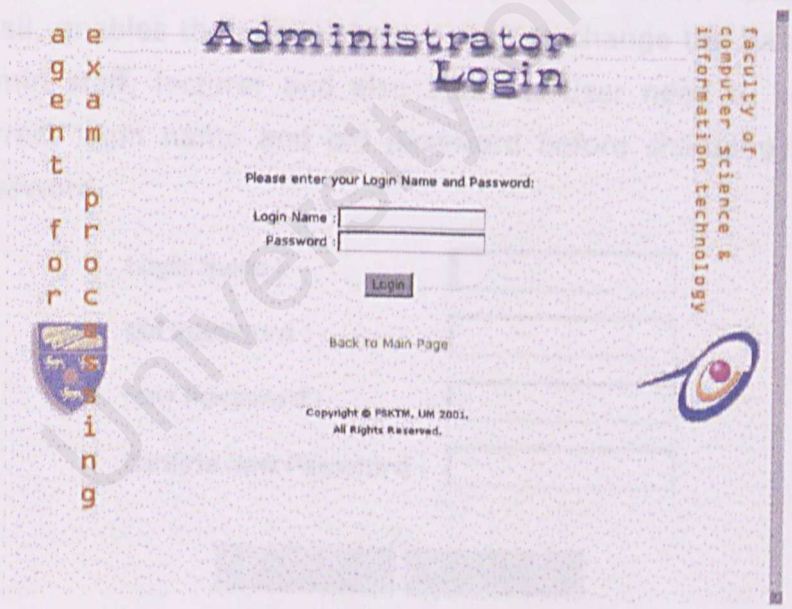

Figure 4.1: Administrator Login Page

Administrative staffs need to key in the login name and password to get authentication into the Agent. Failing to do so will not permit the user to access the Agent.

4.2 Main Section

After the administrative staff has logged in, they will see a main screen with six choices of modules that serves different functions.

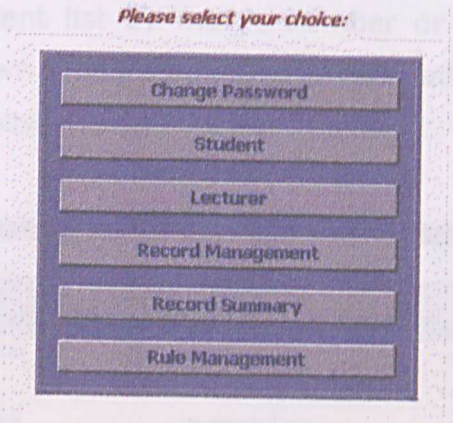

Figure 4.2: The main section of Admin

4.3 Change Password Module

Firstly, the change password module, which is the simplest module of all, enables the administrative staff to change the password for admin staff, lecturer and also student. User need to key in the correct login name and old password before changing to a new password.

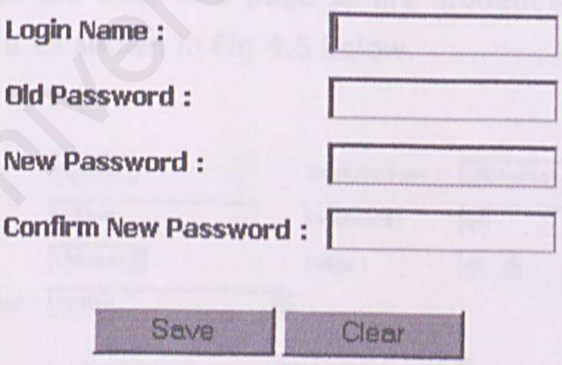

Figure 4.3: Change Password Module

4.4 Student Module

The Student Module will show all the registered students in the faculty of Computer Science and Information Technology. User can view the student list by matric number or by name. From the screen as shown in Fig 4.4, user can add, edit and delete student from the database.

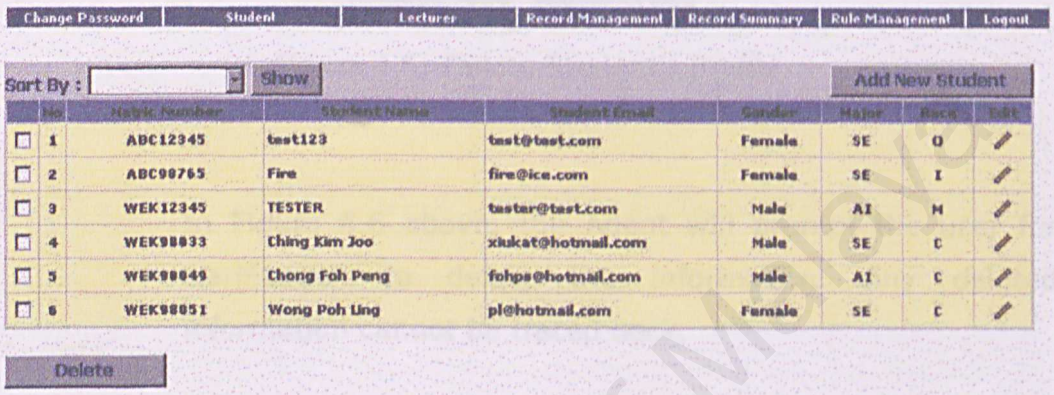

Figure 4.4: Student Module in Administrator Section

4.4.1 Add / Edit / Delete Student

Clicking on the little edit icon on the right side of the table brings the user to a page where student's profile could be edited as shown in Fig 4.5 below.

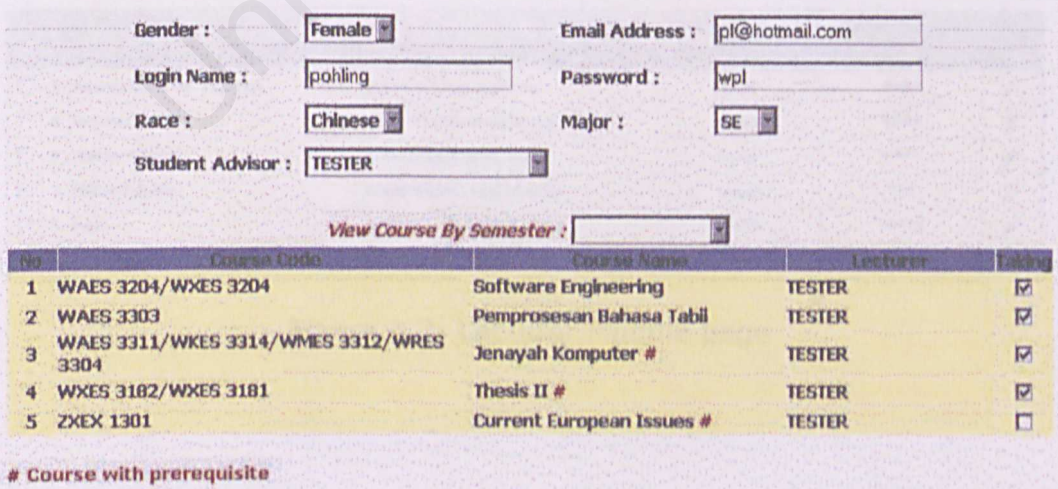

Figure 4.5: Edit Student's Profile in Administrator Section

The lower part in Figure 4.5 shows the courses that are offered in that semester. Administrative staff could set the course taken by the student in any particular semester.

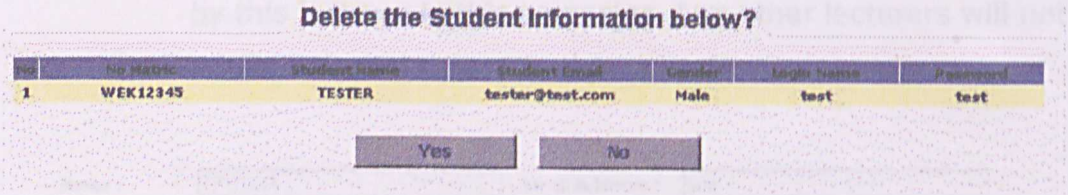

Figure 4.6: Delete Student's Profile

In Figure 4.6 above, the Agent will prompt the user for clarification to delete the information. Any deleted information cannot be traced back.

4.5 Lecturer Module

The third module in Administrator Section is the Lecturer Module, which brings the user to an interface shown in Figure 4.7 below. It shows all the registered lecturer's information. Here the administrators can add, edit and delete lecturer's information.

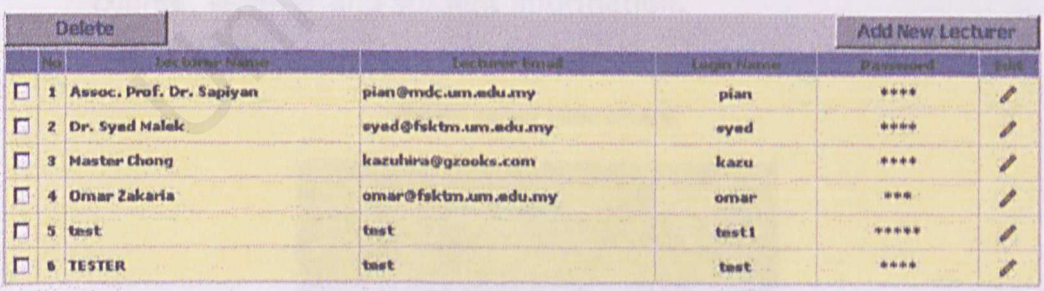

Figure 4.7: Lecturer Module page

4.5.1 Add / Edit / Delete Lecturer

Similar to the model in Student Module, this section (Figure 4.8) is where the administrators could edit the lecturer's profile. The lower part shows the courses that will be taught by this lecturer in this semester. Any other lecturers will not take a selected course in the semester.

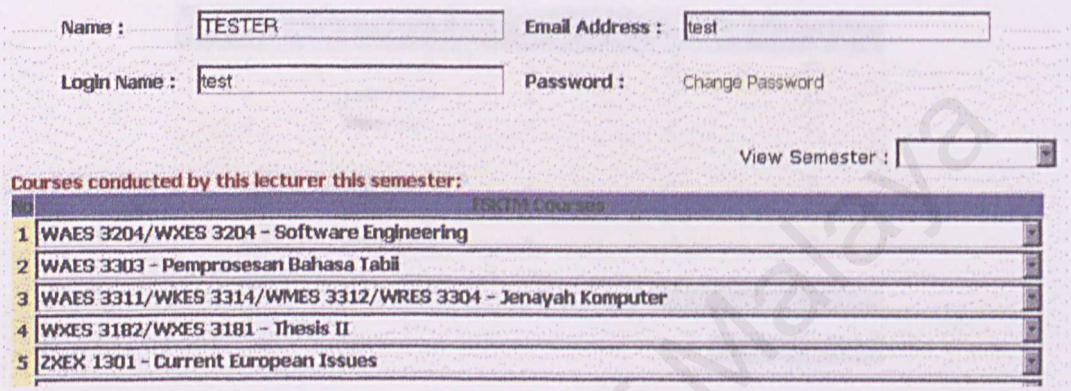

Figure 4.8: Editing Lecturer's Profile

4.6 Record Management Module

The fourth module, Record Management Module, gives the administrators full access to all the data stored in the database. As shown in Figure 4.9, administrators can control the semester, course, lecturer and student information.

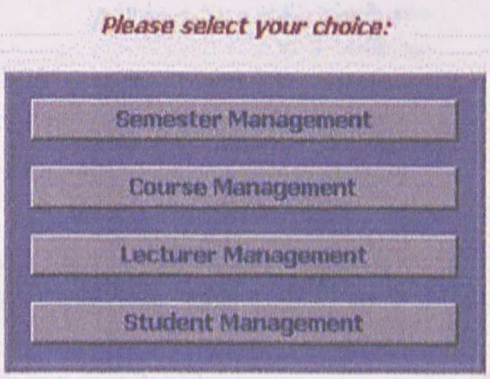

Figure 4.9: Record Management Module

4.6.1 Semester Management

In semester management of the Record Management Module, we could see the semesters laid out in a table as shown in Figure 4.10. Administrators could set the current semester as the default semester. By clicking the view icon, the Agent will show the courses offered in that semester.

Semester	Session	Number of Course	View	Default Semester
1	1999/2000	2		○
2	1999/2000	1		○
3	1999/2000	0		○
1	2000/2001	2		○
2	2000/2001	5		◉
3	2000/2001	0		○

Update Default Semester

Add New Semester

Figure 4.10: Semester Management

4.6.2 Course Management

The course management model gives the authority to the administrator to add, edit and delete a course in the semester.

Sort By : Show Add New Course

	No	Course Code	Course Name	Semester	Session	Lecturer	Edit	Marks
☐	1	WAES 3204 / WXES 3284	Software Engineering	2	1999/2000	TESTER		
☐				1	1999/2000	TESTER		
☐				2	2000/2001	TESTER		
☐	2	WAES 3303	Pemprosesan Bahasa Tabii	2	2000/2001	TESTER		
☐	3	WAES 3307	Rangkaian Neural Buatan	1	2000/2001	TESTER		
☐	4	WAES 3311 / WKES 3314 / WMES 3312 / WRES 3304	Jenayah Komputer	2	2000/2001	TESTER		
☐				1	2000/2001	TESTER		
☐	5	WXES 3182 / WXES 3181	Thesis II	2	2000/2001	TESTER		
☐	6	ZXEX 1301	Current European Issues	1	1999/2000	TESTER		
☐				2	2000/2001	TESTER		

Delete

Figure 4.11: Course Management

Courses are added automatically to the semester whenever a lecturer is assigned to that course. From the interface in Figure 4.11 and Figure 4.12, administrators can edit the marks allocation, student marks and edit the course information such as changing the course code.

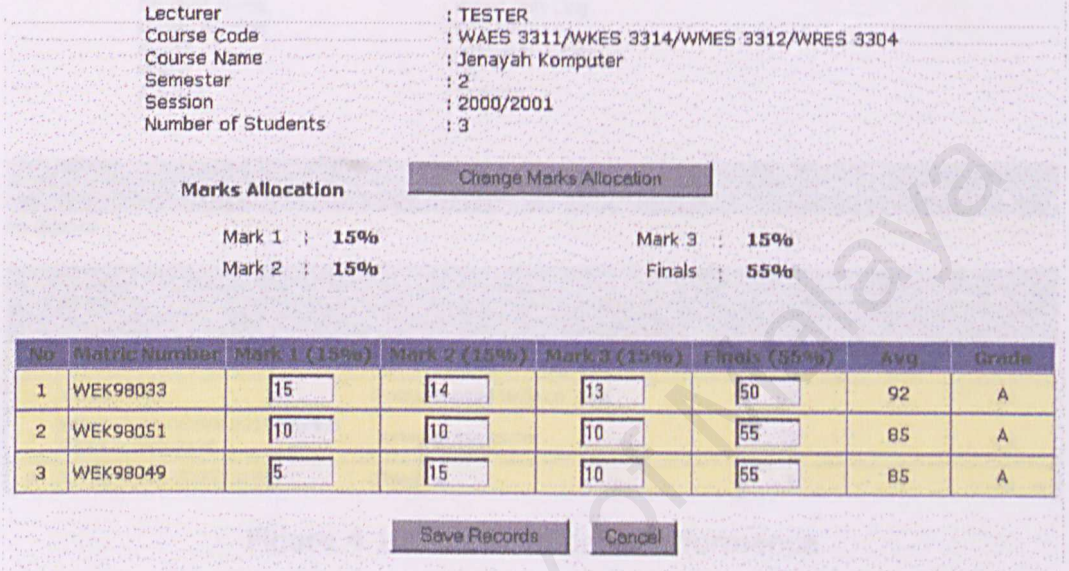

Figure 4.12: Editing Student's Marks for Course

In the table shown in the lower section of Figure 4.12, administrators can change a student's marks and preview its results instantaneously.

Either the lecturer or the administrator sets the marks allocations. The marks keyed in for the students will be controlled and checked against these values of allocation to make sure that it do not exceeds the limit.

4.6.3 Student Management

The Student Management Module gives a summary of the student's performance throughout the whole course. Figure 4.13 below shows part of the details that shows the results of a particular student.

Student Name : Wong Poh Ling
Matric Number : WEK98051
E-mail : pl@hotmail.com
Major : SE
Advisor : TESTER

Semester - 3 Session - 2000/2001					
No	Course Code	Course Name	Credits	Grade	Grade Point
No Record					

Semester - 2 Session - 2000/2001					
No	Course Code	Course Name	Credits	Grade	Grade Point
1	WAES 3204/WXES 3204	Software Engineering	3	A-	11.1
2	WAES 3303	Pemprosesan Bahasa Tabii	3	A	12
3	WAES 3311/WKES 3314/WMES 3312/WRES 3304	Jenayah Komputer	3	A	12
4	WXES 3182/WXES 3181	Thesis II	4	A	16

Figure 4.13: View Student Performance

4.7 Record Summary Module

The Record Summary Module summarizes the courses information according to semester as shown in Figure 4.14. By clicking the view icon, administrators can view the course results as shown in Figure 4.15.

Semester - 2 Session - 2000/2001					
No	Course Code	Course Name	No of Students	Lecturer	View
1	ZXEX 1301	Current European Issues	0	TESTER	
2	WXES 3182 WXES 3181	Thesis II	2	TESTER	
3	WAES 3311 WKES 3314 WMES 3312 WRES 3304	Jenayah Komputer	3	TESTER	
4	WAES 3303	Pemprosesan Bahasa Tabii	2	TESTER	
5	WAES 3204 WXES 3204	Software Engineering	2	TESTER	

Figure 4.14: Record Summary Model according to Semester

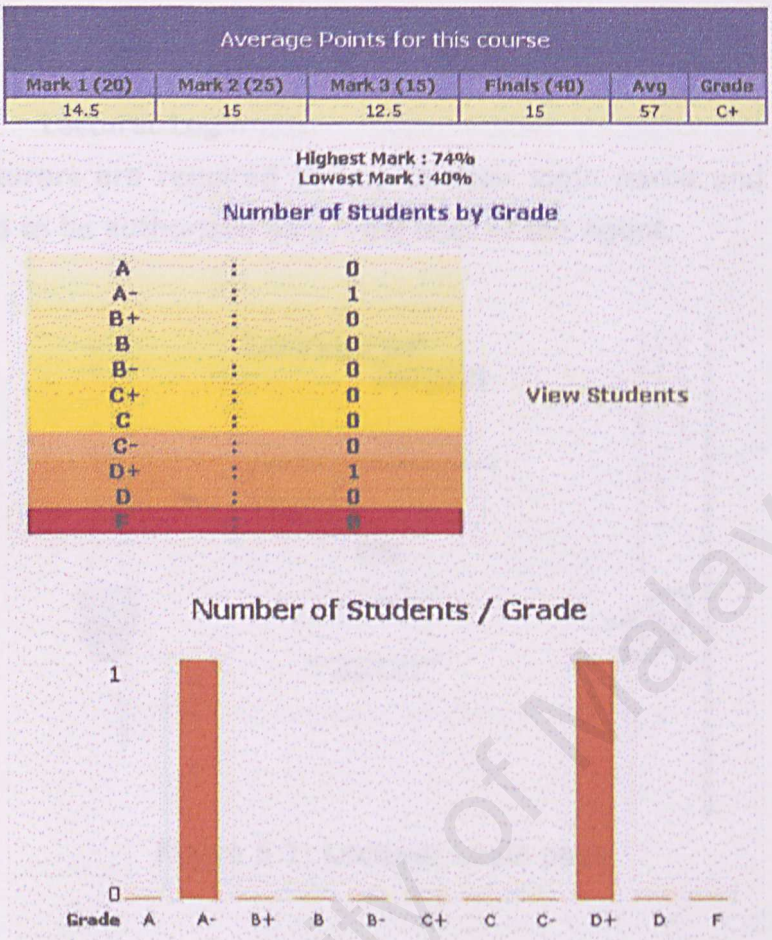

Figure 4.15: View Student Summary Model

4.8 Rule Management Module

The Rule Management Module gives the administrators the power to control changes in prerequisites and passing points for certain subjects. The rules here can either be inactive or activated by the administrator.

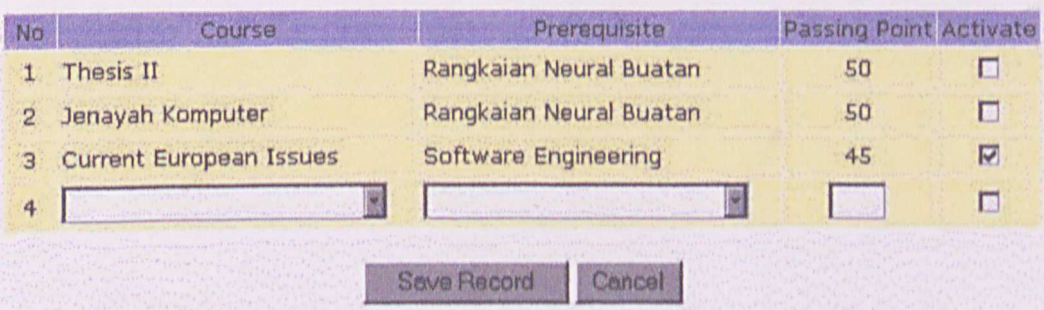

Figure 4.16: Rule Management Module

5.0 LECTURER SECTION

5.1 Lecturer Login

Lecturers are required to key in their login name and password here to be authorized as a legal user of the Agent.

Figure 5.1: Lecturer Login page

5.2 Main Page

The main page of the Lecturer Section is shown in Figure 5.2. It gives the lecturers quick access to change their name, login name, and email address by just a simple click.

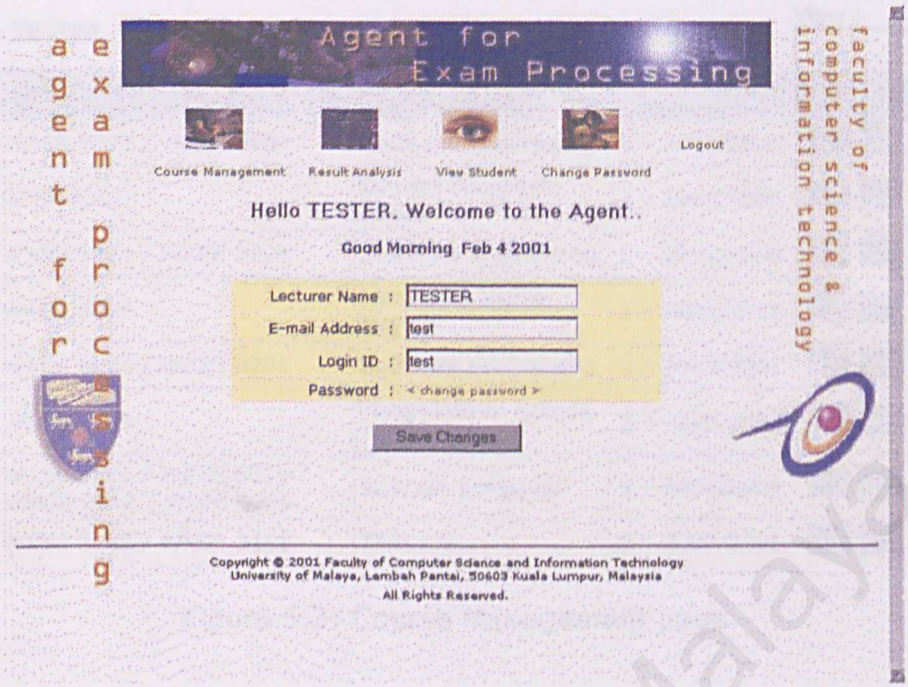

Figure 5.2: Lecturer Section Main Page

5.3 Course Management Module

This module summarizes all the courses that are handled by the lecturer. Lecturers could choose either to view the all information or by semester. As shown in Figure 5.3, lecturer could change the course's information, edit marks allocation, key in student's exam marks and view results by clicking on the icons on the right.

Hello **TESTER**, How are you today ?

View :

No	Course Code	Course Name	Semester / Session	Edit
1	WAES 3204 / WXES 3204	Software Engineering	1 - 1999/2000	
2	ZXEX 1301	Current European Issues	1 - 1999/2000	
3	WAES 3204 / WXES 3204	Software Engineering	2 - 1999/2000	
4	WAES 3307	Rangkaian Neural Buatan	1 - 2000/2001	
5	WAES 3204 / WXES 3204	Software Engineering	2 - 2000/2001	
6	WAES 3303	Pemprosesan Bahasa Tabii	2 - 2000/2001	
7	WAES 3311 / WKES 3314 / WMES 3312 / WRES 3304	Jenayah Komputer	2 - 2000/2001	
8	WXES 3182 / WXES 3181	Thesis II	2 - 2000/2001	

Figure 5.3: Course Management page

5.3.1 Marks Allocation Section

Marks Allocation

Mark 1 : 20 Mark 2 : 25

Mark 3 : 15 Mark 4 : 40

Submit Cancel

Edit Student Marks

Figure 5.4: Marks Allocation Section

5.3.2 Edit Marks Section

Course Code : WAES 3311/WKES 3314/WMES 3312/WRES 3304
Course Name : Jenayah Komputer
Semester : 2
Session : 2000/2001
Number of Students : 4

No	Matric Number	Mark 1 (15%)	Mark 2 (15%)	Mark 3 (15%)	Finals (55%)	Avg	Grade
1	WEK98033	15	14	13	50	92	A
2	TESTER	2	3	4	55	64	B
3	WEK98051	10	10	10	55	85	A
4	WEK98049	5	15	10	55	85	A

Save Records Cancel

Figure 5.5: Edit Marks Section

5.4 View Student Module

This module enables the lecturer to view all the students supervised by him/her. From here, lecturers could view their performance and also mail to them for announcement or any other purposes.

Students Supervised by TESTER

Mail To All Students

No	Matric No	Student Name	Major	Advisor
1	WEK98033	Ching Kim Joo	SE	TESTER
2	WEK98049	Chong Foh Peng	AI	TESTER
3	ABC98765	Fire	SE	TESTER
4	ABC12345	test123	SE	TESTER
5	TESTER	tester	AI	TESTER
6	WEK98051	Wong Poh Ling	SE	TESTER

Figure 5.6: View Student Module

5.4.1 Mail Student Model

To : fohps@hotmail.com

Bcc : test@test.com,fire@ice.com,xiukat@hotmail.com,pl@hotmail.com,tester@test.com

Subject :

Message :

Submit Cancel

Figure 5.7: Mail All Students Model

5.5 Change Password Module

The changing password module is exactly the same as the one in Administrator Section.

6.0 STUDENT SECTION

6.1 Student Login

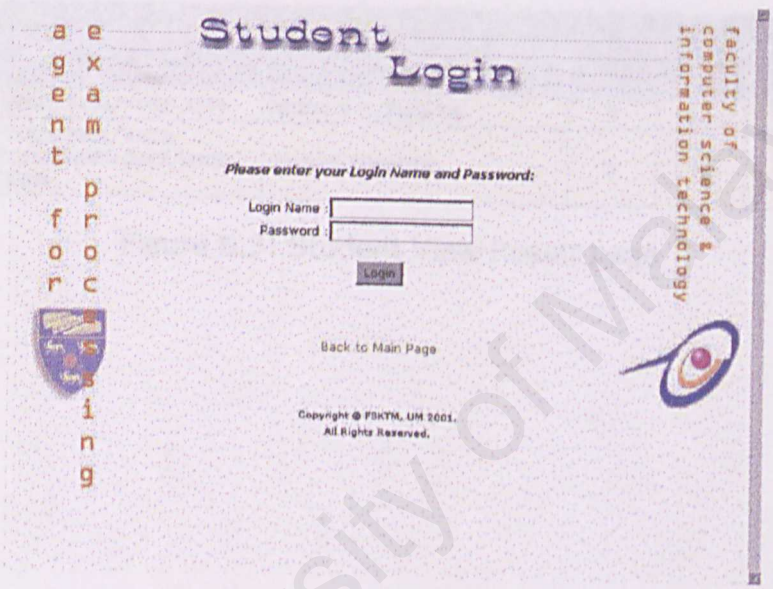

Figure 6.1: Student Login Page

6.2 Student Main Page

Hello Chong Foh Peng. Welcome to the Agent..

Good Morning Feb 5 2001

Student Name	:	Chong Foh Peng
Matric No	:	WEK98049
Major	:	AI
Login Name	:	fohps
Advisor	:	TESTER
Email	:	fohps@hotmail.com <change>

Figure 6.2: Student Main Page

6.3 Student View Result

This module enables students to view their results by the end of the semester when the results are out. It also shows all the results from the first semester of the student.

Semester - 3 Session - 2000/2001

No	Course Code	Course Name	Credits	Grade	Grade Point
No Record					

Semester - 2 Session - 2000/2001

No	Course Code	Course Name	Credits	Grade	Grade Point
1	WAES 3204/WXES 3204	Software Engineering	3	D+	4.5
2	WAES 3311/WKES 3314/WMES 3312/WRES 3304	Jenayah Komputer	3	A	12

Figure 6.3: Student View Result page